Science Policy Study—Hearings Volume 21
THE ROLE OF THE NATIONAL ACADEMIES

HEARINGS

BEFORE THE

TASK FORCE ON SCIENCE POLICY

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

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CONTENTS

WITNESSES

May 6, 1986:

Page

- Dr. George A. Keyworth II, chairman, Keyworth/Meyer International, Washington, DC, and former science adviser to the President, and Director of White House Office of Science and Technology Policy 2
  - Prepared statement 6
  - Discussion 17
- Thomas D. Larson, P.E., secretary, Pennsylvania Department of Transportation, Harrisburg, PA 19
  - Prepared statement 23
  - Discussion 34
- Dr. James B. Wyngaarden, Director, National Institutes of Health, Bethesda, MD 37
  - Discussion 41
- Dr. R. Duncan Luce, Victor S. Thomas, Professor of Psychology, Harvard University, Cambridge, MA 43
  - Prepared statement 50
  - Discussion 63

May 7, 1986:

- John S. Coleman, Arlington, VA, former executive officer, National Academy of Sciences 68
  - Prepared statement 70
  - Discussion 80
- Dr. Peter H. Raven, director, Missouri Botanical Gardens, St. Louis, MO 82
  - Discussion 87

PANEL: PRESIDENTS OF THE ACADEMY COMPLEX

May 8, 1986:

- Dr. Frank Press, president, National Academy of Sciences, Washington, DC 104
  - Prepared statement 109
- Dr. Robert M. White, president, National Academy of Engineering, Washington, DC 127
  - Prepared statement 132
- Dr. Sammuel O. Thier, president, Institute of Medicine, Washington, DC 138
  - Prepared statement 142
  - Program themes 152
  - Panel discussion 169
- Dr. Denis J. Prager, deputy director, Health Program, John D. and Catherine T. MacArthur Foundation, Chicago, IL 177
  - Prepared statement 185
  - Discussion 201

Appendix 1: "A Chronicle of Public Laws Calling for Action Under the Charter of the National Academy of Sciences," National Academy Press, Washington, DC, 1985 205

Appendix 2: Additional materials concerning the National Academy of Engineering:

- "The National Academy of Engineering: Technological Leadership in the Nation's Service" 423
- "National Academy of Engineering Program Report 1 July 1985—30 June 1985," National Academy of Engineering, Washington, DC, 1986 451

THE ROLE OF THE NATIONAL ACADEMIES

TUESDAY, MAY 6, 1986

House of Representatives,
Committee on Science and Technology,
Task Force on Science Policy,
Washington, DC.

The task force met, pursuant to call, at 10 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the task force) presiding.

Mr. Fuqua. Today we begin a 3-day series of hearings on the subject of the future role of the national academies. The national academies are a unique American institution. They constitute a strong, independent, scientific, technical, and policy advisory group for the entire Federal Government. There is no question that the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and their operating arm, the National Research Council, have made many valuable contributions to science and technology in the United States.

Our goal for these hearings is to determine what role the national academies should play in helping the Federal Government shape the future direction of America's science and technology and how that role can can best be performed.

Our first witness today is Dr. George Keyworth, former science adviser to the President and Director of the Office of Science and Technology Policy. He utilized the academies to assist him, and also observed the academies' interactions with the other parts of the Federal science and technology establishment.

Following Dr. Keyworth will be Dr. Thomas Larson, who is the Pennsylvania Secretary of Transportation. He is a member of the Academy of Engineering and various transportation panels, and he will provide us with a different view of the academy's advisory mechanism and its use by the States. The third witness today is Dr. James Wyngaarden, the Director of the National Institutes of Health, and a member of both the National Academy of Sciences and the Institute of Medicine. Dr. Wyngaarden will address the utilization of the academies by the National Institutes of Health, and their future impact on American science policy.

The final witness will be Dr. Duncan Luce of Harvard University Psychology Department. He will address an often neglected area, the social sciences, and what role the academies play in this area.

We are very pleased to welcome back Dr. Keyworth who has been here many, many times. We are glad to see you again and to see that you are surviving and doing well, Dr. Keyworth.

STATEMENT OF DR. GEORGE A. KEYWORTH II, CHAIRMAN, KEYWORTH/MEYER INTERNATIONAL, WASHINGTON, DC, AND FORMER SCIENCE ADVISER TO THE PRESIDENT, AND DIRECTOR OF THE WHITE HOUSE OFFICE OF SCIENCE AND TECHNOLOGY POLICY [OSTP]

Dr. KEYWORTH. Thank you very much, Mr. Chairman. If I may, I would like to read an abbreviated version of my testimony and submit the whole for the record.

Mr. FUQUA. Yes, we will make the prepared part a part of the record, and if you wish to summarize, that would be fine.

Dr. KEYWORTH. As always, I am pleased to meet with the Science and Technology Committee, and I am glad to get in under the wire to finally meet with the Task Force on Science Policy. Before I address the specific issues at hand, I would like to say just a few words about this committee itself. During my nearly 5 years as science adviser, I inevitably enjoyed and was stimulated by appearances here, and I always considered your oversight hearings on the President's proposed R&D budgets as the most comprehensive look taken at science policy throughout the year. In a very real sense, by virtue of the committee's focus and on the time it devotes to science and technology issues, this committee has been a key forum for national science policy over the years, and, moreover, Mr. Chairman, much of the success of the committee in building this role is due to your own efforts. I know I speak for the science community when I say that we will miss your presence after this year. Speaking personally, I am pleased that you will at least remain in Washington where we can all continue to draw on your experience and leadership.

Now—to today's topic. The task force has posed an extensive series of questions about the role of the national academies. Rather than address them specifically, I would like to reflect on my own experience in the White House Science Office, as someone whose responsibilities for formulating and implementing science policy were critically dependent on the quality and on the timeliness of expert information, analyses, and recommendations.

Those inputs came from many individuals and groups, as they should, and I would say that the academies can be thought of as one of many sources of expertise to draw on. Of course, my own experience with the academies reflects only a small, albeit highly visible, part of their efforts. The bulk of academy work—the many contract studies performed under sponsorship of Federal agencies and the Congress—has little direct impact at the White House level of policymaking, though the substantial knowledge and analyses generated through those studies are obviously reflected in subsequent recommendations passed on by the agencies themselves.

In the White House, we had to be highly demanding and selective about the kinds of policy input that we could use effectively, and, to set that in perspective, I have to restate something that I have said many times before. Science advising is not advising the President about what is good for science and technology. It is advising the President about the impacts of science and technology on national policy. That means a major part of the science adviser's job is to anticipate issues in which he is likely to be called upon for advice—and to make sure that he has the best possible array of options to consider. As a result, events external to the science and technology community control much of the science adviser's agenda—something that has always been difficult for the science community to accept or even understand.

If it is any one thing I would have the science community appreciate, it is how much more effective roles they could play if they could think more in terms of that national agenda.

With that in mind, it is clearer why policymakers seek information through multiple channels, and it might prove instructive for me to briefly run through the kinds of advisory bodies that I did draw on in the White House as a way of establishing some perspective for how the academies, in particular, fit into that level of policymaking. My primary source of outside advice was, not surprisingly, the White House Science Council, which, also not surprisingly, was composed largely of people who are also members of the academies. In addition to the invaluable informal advice I got from them on a regular basis, and I cannot overemphasize just how important that was, I also asked them to undertake formal studies from time to time. Among those were the two Packard studies—the first being our national laboratories, and the second being the recently released report on the health of universities. We also did a study at the request of the Federal Aviation Administration of their proposed national airspace plan, and I asked the Council to set up several panels to look at broad defense technology issues. One of those studies, as an example, was instrumental in the President's decision to propose the Strategic Defense Initiative. In other instances, we set up ad hoc panels outside of the Council, sometimes within OSTP, sometimes as interagency groups under the Federal Coordinating Council for Science, Engineering, and Technology. Among those were panels—generally composed of both Government and private sector experts—that assessed the state of our knowledge about carcinogens and about acid rain, that looked at research opportunities in aeronautics and supercomputers, at the prospects for biotechnology and agriculture and so on.

Now, in my first year in the White House, my initial interaction with the community both as represented in the academies, and in the societies and associations was, frankly, discouraging. I fou~~nd it~~ perplexing that something that good scientists can do so well—which is to evaluate and rank the quality of research—was something that they were often reluctant to do when assembled in a group within the beltway. Since a major part of my job was to help put together the R&D budget, I needed to note two things: What should be the priorities for supportive research within a discipline, and what should be the priorities for support within science and engineering overall?

In a few cases we were able to get straightforward answers to that first question. The best example was always the academies' astronomers, who periodically bit the bullet and published a rank-ordered list of facilities that they believed should be funded. Next, but a long way down the list, are my fellow physicists who, if locked in a room and deprived of food and drink, could sometimes agree on priorities for major new facilities. Most of the rest of the disciplines simply lacked the resolve or the pressure to say one part of their field was more important than another, so their recommendation was usually to provide increased funding across the board for their discipline. Now, that wasn't going to happen, so why they thought it made more sense to leave those kinds of decisions to the Office of Management and Budget, I'll never know, but in many cases that was the result of their reluctance.

But the larger problem was how to make comparisons between fields of science. As we know, the first part of this decade was marked by substantial growth in Federal funding for basic research, but I was by no means uniform across the board. I think we made good decisions about those relative priorities, but let me make it clear that we did so without any great help from the science establishment itself early in the eighties.

That has been slowly changing, and changing for the better, and here at least the academies must be credited with recognizing the problem and responding to it. In particular, I would single out the leadership that the late George Low brought to the academies' Committee on Science, Engineering, and Public Policy [COSEPUP]. When COSEPUP first offered to put together a series of briefings for OSTP on topics of importance to science and technology, I believe their intention was to educate the science adviser, to instruct him in what he ought to think was important in the world of science, and I listened, found them variably interesting as descriptions of exciting academic research, but I was left only a little more prepared to make or implement policy than before I heard them. Why? Because, as I said, they shied away from ordering priorities. They hung back from identifying connections with the world outside of research, and they didn't address topics that the administration was most concerned with, which is to say they focused on the academies' wish list, not on what was on the policy table at that time.

But happily, we all learned from that first round, and in succeeding years OSTP and COSEPUP spent much more time in selecting the topics to be evaluated. We always had some differences in how to approach the task in that the academy never gave up—nor should they have—in trying to use the process to bring smoldering subjects to the forefront, while I insisted on focussing on the half dozen issues I knew I would have to cope with in the coming year and needed their help on. George Low was an astute man, and he turned that COSEPUP process into one that began to have real policy impact.

One of the most successful of those studies—the 1983 briefing on "Computers in Design and Manufacturing"—catalyzed the rapid policy movement to stimulate industry-university multidisciplinary research centers. In that case, a COSEPUP briefing led, within a matter of months, to action by the National Academy of Engineering to flush out an NSF program for engineering research centers. That episode, which also reflected the growing and changing role of the National Academy of Engineering [NAE], stands as probably the best example I encountered where the Academy played a central and timely role in development and implementation of policy. It was a success because the community and the Government were in sync, were working in response to commonly perceived needs, and were able to rally broad support for their recommendations. I only wish that model were more frequently followed.

Finally, a word about the changes in the academy over the last few years. The emergence of the NAE as a strong and independent organization has been extremely beneficial. Its rise parallels the rise of the importance of engineering and of technology as concerns for Government. What I find most encouraging is that the NAE has given us a better means of bringing technical expertise and perspectives from industry into R&D policy deliberations. With one of our major national goals being to improve our effectiveness in converting science into industrial and economic advantage, I foresee the possibility of an increasingly important role for the NAE.

Mr. Chairman, this concludes my formal statement, and I would be pleased to respond to any questions you may have.

[The prepared statement of Dr. Keyworth follows:]

Proposed Testimony of Dr. G. A. Keyworth, II
Chairman, Keyworth/Meyer International
Washington, D.C.

To the Task Force on Science Policy of the
Committee on Science and Technology
United States House of Representatives

May 6, 1986

Mr. Chairman and Members of the Committee:

As always, I'm pleased to meet with Members of the Science and Technology Committee, and I'm glad to get in under the wire to finally meet with the Task Force on Science and Technology. Before I address the specific issues at hand, I'd like to say a few words about this Committee itself. During my five years as Science Advisor, I inevitably enjoyed and was stimulated by appearances here, and I always considered your oversight hearings on the President's proposed R&D budgets as the most comprehensive look taken at science policy throughout the year. In a very real sense, by virtue of the Committee's focus and of the time it devotes to science and technology issues, this Committee has been a key forum for national science policy over the years. Moreover, Mr. Chairman, much of the success of the Committee in building this role is due to your efforts, and I know I speak for the science community when I say we will miss your presence after this year. Speaking personally, I'm pleased that you'll at least remain in Washington where we can continue to draw on your experience and leadership.

Now--to today's topic. The Task Force has posed an extensive series of questions about the role of the National Academies. Rather than address them specifically, I'd like to reflect on my own experience, in the White House Science Office, as someone whose responsibilities for formulating and implementing science policy were critically dependent on the quality and timeliness of expert information, analyses, and recommendations.

Those inputs came from many individuals and groups, as they should, and I would say that the Academies can be thought of as one of many sources of expertise to draw on. Of course, my own experience with the Academies reflects only a small, albeit highly visible part of their efforts. The bulk of Academy work--the many contract studies performed under sponsorship of federal agencies and the Congress--has little direct impact at the White House level of policymaking, though the substantial knowledge and analysis generated through those studies are obviously reflected in subsequent recommendations passed on by the agencies themselves.

In the White House, we had to be highly demanding and selective about the kinds of policy input we could use effectively. To set that in perspective, I have to restate something I've said many times before. Science advising is not advising the President about what's good for science and technology. It is advising the President about the impacts of science and technology on national policy. That means a major part of the Science Advisor's job is to anticipate issues in which he's likely to be called upon for advice--and to make sure he has the best possible array of options to consider. As a result, events external to the science and technology community control much of the Science Advisor's agenda--something that has always been difficult for the science community to accept or even understand. If there's any one thing I would have the science community appreciate, it's how much more effective roles they could play if they could think more in terms of that national agenda.

With that in mind, it's clearer why policy-makers seek information through multiple channels. It might prove instructive for me to run through the kinds of advisory bodies that I drew on in the White House as a way of establishing some perspective for how the Academies in particular fit into that level of policymaking. My primary source of outside advice was, not surprisingly, the White House Science Council which, also not surprisingly, was composed largely of people who were also members of the Academies. In addition to the invaluable informal advice I got from them on a regular basis, and I can't overemphasize how important that was, I also asked them to undertake formal studies from time to time. Among those were the two Packard studies--the first being on national laboratories, and the second being the recently released report on the health of universities. We also did a study, at the request of the Federal Aviation Administration, of their proposed National Airspace Plan, and I asked the Council to set up several panels to look at broad defense technology issues. One of those studies, as an example, was instrumental in the President's decision to propose the Strategic Defense Initiative. In other instances we set up ad hoc panels outside of the Council, sometimes within OSTP, sometimes as inter-agency groups under the Federal Coordinating Council for Science, Engineering, and Technology. Among those were panels--generally composed of both government and private sector experts--that assessed the state of our knowledge about carcinogens and about acid rain, that looked at research opportunities in aeronautics and supercomputers, at the prospects for biotechnology in agriculture, and so on.

A fair question might be why we chose to set up our own groups rather than turn to the Academies to do those studies for us. After all, they were all heavily based in science or technology and required the judgment of technical experts. The answers differ, but all have a common thread, which is the degree to which a study can actually meet the needs of the policymaker.

In some cases we needed results quickly because the issue demanded near-term action. In other cases we felt that necessary expertise resided in the research agencies or that the nature of the issue demanded inter-agency consensus-building toward concerted action. In other words, the process of doing the study also established the means to implement the conclusions. And in other cases we were asking that the advice be carried to the point of offering or endorsing realistic policy options, which is to say that we required that the participants of the study make that difficult bridge between having the best idea and having the most workable idea--a bridge crossing that gives many scientists vertigo. An interesting observation is that we often found that Academy members were more willing to talk about steps toward implementation of priorities when they were working on Science Council panels or OSTP ad hoc groups than when they were working on studies under Academy aegis. Academy groups are much more likely to insist that they remain within the well defined boundaries of the scientific and technical issues. That's fine as long as the issues are of concern only to that community, but increasingly they aren't so neatly confined.

Please understand, this is not a value judgment, simply an operational observation. But it's one that's important to be aware of, because it so often limits the way in which advice from the science community can be used. My own prescription for changing that situation is to encourage the science community, and certainly the Academies, to explore ways to broaden not so much their participation as their contribution to solving policy problems. That means better understanding the real, as opposed to ideal, world in which political action inevitably takes place, but it seems to me that science and technology, because of their pervasiveness in so much of what happens today, are being drawn inevitably into that kind of adaptive role.

Admittedly, this is a two-way street, and we might just as well fault the policymakers who don't themselves reach across the chasm to try to understand better the scientific issues and implications that affect their actions. But that's a an old complaint, and it's deficient in one fundamental way. Scientists can study problems to their hearts' content, waiting until the perfect solution appears and feeling they've gone far enough by producing a recommendation that "more study is needed." But there are many times when issues demand action, and it's the policy implementers, often people up here on the Hill, who can't take that refuge. So we can say that both sides have a responsibility to reach toward the other, but it's clear that the major responsibility is on the scientists, because their disdain for accomodating their analysis and recommendations to the world of unpostponable decisions too often renders their expertise irrelevant.

There is another kind of science advice in which the situation is much better--and that's when the community is asked to deal with the issues that are more clearly confined to science or technology. Obviously, there's a large portion of government policy that deals either directly or in substantial measure with the intellectual and physical health of science and technology.

The Reagan Adminstration, as we've discussed many times in the past, made an extraordinary commitment to strengthening American science and technology as a means of bolstering our faltering industrial base and our national defense. So when we looked at setting priorities for federal R&D, we made it clear that while we intended to amplify on the general theme that the best and most creative science and technology was generally going to be the most important in meeting those needs, we also asked that those broad national criteria be used to guide our identification of special needs and opportunities in R&D

priorities. That was easier asked than achieved, at least in the first year or so of the Reagan Administration.

In my first year in the White House, my initial interaction with the community, both as represented in the Academies and in the societies and associations, was, frankly, discouraging. I found it perplexing that something that good scientists can do so well--which is to evaluate and rank the quality of research--was something that they were reluctant to do when assembled in a group within the Beltway. Since a major part of my job was to help put together the R&D budget, I needed to know two things: What should be the priorities for support of research within a discipline, and what should be the priorities for support within science and engineering overall.

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That has been slowly changing for the better, and here at least the Academies must be credited with recognizing the problem and responding to it. In particular I would single out the leadership that the late George Low brought to the Academies' Committee on Science, Engineering, and Public Policy. When COSEPUP first offered to put together a series of briefings for OSTP on topics of importance to science and technology, I believe their intention was to "educate" the Science Advisor, to instruct him in what he ought to think was important in the world of science. I listened, found them variably interesting as descriptions of exciting academic research, but was left little more prepared to make or implement policy than before I heard them. Why? Because, as I said, they shied away from ordering priorities, they hung back from identifying connections with the world outside of research, and they didn't address topics that the Administration was most concerned with, which is to say they focussed on the Academies' wish list, not on what was on the policy table at the time.

Happily, we all learned from that first round. In succeeding years OSTP and COSEPUP spent much more time in selecting the topics to be evaluated. We always had some differences in how to approach the task, in that the Academy never gave up--nor should they have--in trying to use the process to bring smoldering subjects to the forefront, while I insisted on focussing on the half dozen issues I knew I would have to cope with in the coming year and needed their help on. George Low was an astute man, and he turned that COSEPUP process into one that began to have real policy impact.

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Engineering to flesh out an NSF program for Engineering Research Centers. That episode, which also reflected the growing and changing role of the National Academy of Engineering, still stands as probably the best example I encountered where the Academy played a central and timely role in development and implementation of policy. It was a success because the community and the government were in synch, were working in response to commonly perceived needs, and were able to rally broad support for their recommendations. I only wish that model were more frequently followed.

Finally, a word about the changes in the Academy over the past few years. The emergence of the NAE as a strong and independent organization has been extremely beneficial. Its rise parallels the rise of the importance of engineering and of technology as concerns for government. What I find most encouraging is that the NAE has given us a better means of bringing technical expertise and perspectives from industry into R&D policy deliberations. With one of our major national goals being to improve our effectiveness in converting science into industrial and economic advantage, I foresee the possibility of an increasingly important role for the NAE.

Mr. Chairman, this concludes my formal statement. I would be pleased to respond to questions from you and the other Members.

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DISCUSSION

Mr. FUQUA. Thank you very much, George. From your experience as the President's science adviser and heading up OSTP, is the present congressional charter for the National Academy of Sciences or all the groups, the Academy of Engineering and Institute of Medicine—is that adequate to meet the needs of the Federal Government and also for the academies in the future?

Dr. KEYWORTH. Basically, Mr. Chairman, I think it is. I think we must recognize, however, that charter should be reviewed time after time, year after year, as our dependence upon science and technology increases. In fact, let me attempt to make a point that I may have overlooked clear, Mr. Chairman.

I think both the leadership of the academy, its relationship with other elements of Government, and its charter are proper, appropriate, and in fact laudable. I think what I have spoken about relates to a problem more within the scientific community itself—its unwillingness over the last 20 years to play a substantive role in the formulation of national policy and how science and technology influences that. So I think the academy is, if you wish, often running up hill, and I think each of the leaders—Frank Press, Bob White, for example, deserve enormous credit, as well as you do, Mr. Chairman, for having improved that process. And I look forward to seeing more of that in the future.

Mr. FUQUA. Would not the academy be a reflection of its members?

Dr. KEYWORTH. Yes; and by the same token, Mr. Chairman, I think that the present leadership to whom I referred has done their very best to try to——

Mr. FUQUA. Steer that.

Dr. KEYWORTH [continuing]. Steer that; to try to introduce more vigor. There are more young people, and there are more who are out in the forefront of pursuit of science and technology and how it is used.

Mr. FUQUA. Well, should the Federal Government take any steps over the longer term to strengthen and augment the ability of the academy to conduct some self-initiating studies?

Dr. KEYWORTH. Yes, I think that is a good approach. I would also suggest that it might be possible to even more frequently ask members of the academy and the academy leadership to help suggest people who could come up and provide candid testimony to this committee, and to other committees, that could be influenced by their expertise. In other words, to play an even broader role in the difficult deliberations that you all have to go through routinely.

Mr. FUQUA. Since the National Academy of Sciences was established, we have added the National Academy of Engineering and the Institute of Medicine, and they have been organized under the charter of the National Academy of Sciences. Would it be worthwhile to issue them separate charters so that they are not under the auspices of the National Academy of Sciences, but separate entities, or should they work together as they are today?

Dr. KEYWORTH. Mr. Chairman, I would strongly recommend against further separation of the Institute of Medicine and NAE and NAS. I think the overreaching umbrella of the National Academy of Sciences is appropriate, and I think it reflects the slow trend that I seen happening in American science, which is making the word "science" more prominent and the subdisciplines less prominent.

I think it is important that the academy function is a total entity. I think the degree of independence that exists within engineering and the biomedical sciences is adequate today, and I think in contrast we really need to see the organization work more as an entity composed of all those disciplines.

Mr. FUQUA. You mentioned that, and that has been one of the subjects that has been brought up before this task force several times, this need for more interdisciplinary interaction, both at the academic level at the college and university and particularly graduate school, but once you get beyond that, society is becoming so complex that engineers have to work with medicine, and medicine has to work with scientists, and it all gets into a kind of circle. The point you made I think is very well taken in that regard.

What extent do the academies incorporate policy concerns into their scientific and technical recommendations, and I guess what I am saying is, should the policy considerations influence the Academy's recommendations, or should the recommendations be the guidelines for the policymakers?

Dr. KEYWORTH. I, of course, would very much prefer to see the latter; namely, the science and technology recommendations be input for policymaking. However, I also think it is important that those who are involved in the studies be aware of the kind of policy deliberations that you, and other members of the legislative and executive branches, are wrestling with. I think we have seen this often, for example, in the environmental areas where what we want from the academies is the best possible scientific and technical advice they can give, but we want it to be in a context in which it pertains to the policy of deliberations before them.

Mr. FUQUA. Do you see a conflict between the National Academy and the Office of Technology Assessment?

Dr. KEYWORTH. Not at all. To me, the Office of Technology Assessment is in large measure an entity to provide the information to support the legislative process and Members of Congress, whereas I see the academy as a means to bring together the very finest technical minds in the United States to focus on specific areas of science and technology. I think these are quite different. Frequently, there is a time-scale difference, and I think that is somewhat inevitable. I think the isolation from Government, specifically, that that the National Academy of Sciences maintains is very healthy.

Mr. FUQUA. Mr. Lundine.

Mr. LUNDINE. I have no questions.

Mr. FUQUA. Dr. Keyworth, thank you very much for being here this morning and sharing with us your experiences with the academy, and we hope to have you back before us again sometime.

Dr. KEYWORTH. Thank you very much, Mr. Chairman. As you know, it has been a pleasure of mine to work with you.

Mr. FUQUA. The next witness will be Dr. Thomas D. Larson, secretary of the Pennsylvania Department of Transportation. Dr. Larson, we are very pleased to have you here this morning, and would be delighted to hear from you at this time. If you have a prepared statement and wish to summarize, we will make it a part of the record.

STATEMENT OF THOMAS D. LARSON, P.E., SECRETARY, PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, HARRISBURG, PA

Mr. Larson. Thank you, Mr. Chairman. I do have a prepared statement, and I will summarize from that statement and be pleased to answer questions following my testimony.

I am Thomas D. Larson, secretary of transportation for the Commonwealth of Pennsylvania and a member of the National Academy of Engineering. I am pleased to respond to your invitation to share my views on the future role of the national academies in providing scientific, technical, and policy advice.

Being from the transportation community, I will focus my testimony on the National Research Council and the Transportation Research Board, a unit of the NRC. Your invitation to testify posed 12 specific questions, and what I thought I might do is address 6 of these that are of particular interest and for which I feel some qualification.

The first of these questions is the question, How have the academies fulfilled their congressional mandate? Clearly, the charge to the academies is a very, very broad one, and it would be difficult to give a general answer, so what I thought I might do is to provide some specific examples of areas in which they have in fact, in my judgment, fulfilled their charge. Before going into that, though, I would comment somewhat anecdotally that transportation is an area where everyone is an expert and no one is an expert, and so we find ourselves in a very complex role that is a constant combination of policy and technology, and the number of innovations that are coming to the fore is, I think, far greater than perhaps the lay public realizes.

My sense is that we are challenged constantly to provide innovations, and, if we don't do that, we literally face the prospect of dying in a world marketplace. The complexity of transportation is illustrated by the millions of miles of air routes, roads, railroads, waterways, and transit systems serving virtually every place that people live, work, shop, or visit. Moreover, the provision of these transportation facilities and services must be coordinated with literally thousands, and I think we can say tens of thousands, of independent political units and interest groups; and the facilities and services that we provide must not only be adequately designed and constructed, they must be safe, efficient, cost effective, and environmentally acceptable—a very, very tall order.

It is in this complex atmosphere of technological advances and of challenges to effectively apply new technology to better serve the transportation needs of American citizens that the expertise provided by TRB is so critical. I want to cover two aspects of TRB's activities that address the charge to the academies. First, will be the research function, and second, the technology exchange.

In the research arena, TRB conducts a very extensive cooperative research effort both in highways and transit. Very briefly, the States have agreed to pool funds that are managed under the auspices of this cooperative research program. Some 20 projects per year surface, and these projects are carefully managed through fruition so that there is a very tightly organized body of information on topics of high interest among all of the States.

I mention three of these, one somewhat esoteric and unseen part of the system is the elastometric bearing pads for bridges. The performance of bridges is a matter of national concern. TRB, through its research program, developed new specifications for these elastometric bearings, and they have been adopted now by the association of the 50 States. Similarly, in the transit area, a research project addressed the topic of the purchase of equipment—a bus fleet—and came up with a method of life-cycle cost analyses that we believe will serve the industry very well into the long-term future. These kinds of topics, I think, show the benefits of true cooperation in an area that is just extraordinarily complex, as I have said.

One other example that I might mention is in providing standardization. One of the things that challenges traffic managers all over the country is the business of estimating capacity of facilities, and so there is a document known as the "Highway Capacity Manual." It is used worldwide, really, and has now been updated and brought into current status by activities of this cooperative research.

We have all heard the statistics that one worker in six in the United States is employed in transportation, and that some 15 to 20 percent of our GNP comes from transportation. These are enormous stakes, and just as important, though, is the role of transportation in preventing accidental death and injury, in maintaining a clean environment, and in shaping urban and regional development. I can say for certainty that, in Pennsylvania, we look at contributions in these key areas as being among the products that we expect and regularly get from this cooperative research program.

Turning now to technology transfer, one of the truisms of the research business is that we often innovate and experiment intensively within our own domains, and then fail to share our information and our findings with the larger world. We use TRB as our window on the world to overcome these kinds of limitations. TRB has a way of addressing, as I have noted, a very decentralized industry. There are some 170 standing committees with 3,000 professionals donating their time to solve current problems.

One example that I will cite—in designing the 1990 census, TRB was asked to review the proposed transportation components. A group of these volunteers was assembled, and in a very short time a report was prepared describing how best to deal with the transportation component of the 1990 census. Another very useful technology sharing tool of TRB is the so-called Transportation Research Information System [TRIS]. This is the senior and most highly developed of the transportation information systems based on modern technology—computer technology—and it is very widely used in Pennsylvania, and among the other States as a way to keep current in a very rapidly evolving field.

Then, finally, TRB conducts an annual meeting where more than 4,500 professionals from throughout this country, and around the world, gather. There are more than 900 technical papers presented, and these are published and are available in all of the transportation agencies in the United States and most of them around the world; more than 225 libraries and 8,000 practicing professionals are the beneficiaries of the technical information that comes out of this process. So, I guess I would answer the first question with a very positive, yes, for the specific areas that I am addressing.

Number 2, Are they effective in meeting the needs of Government agencies and in addressing policy concerns?

Increasingly, the process of building and operating our complex transportation systems involves both technical and policy considerations. Indeed, I believe that key issues facing the transportation industry today cannot be resolved with technical solutions alone.

We must fine tune technical solutions within their political context. A distinguishing characteristic of TRB is that it provides the expertise and the forum necessary to present technical knowledge so that it can be understood and assessed within a highly charged political environment, and to make my point I site three examples.

The Congress, with the Surface Transportation Assistance Act of 1982, asked the NRC to assess the consequences of the national 55-mile-speed limit. A report was delivered, and it gave the Congress the necessary facts and figures to deal with this politically sensitive topic. A second charge from the Congress was to review the future professional staffing needs of Government transportation agencies. This, in large consequence, to the concern that we were at the end of an era—the post World War II buildup had come to an end, the interstate era—and we found that more than 40 percent of the professional work force in some agencies was due for retirement. That report has been issued and is right now guiding many agencies, including Pennsylvania, in shaping their manpower, procurement, and management approaches in a more sensitive, intelligent way than otherwise would have been possible.

As a third example, air traffic certainly is increasing around the country. The prospect for adding new facilities is minimal in many places. The Federal Aviation Administration asked the TRB to look at the landside component of air service to see what were the constraints to be faced in getting people to the airport as opposed to moving them out, and that landside capacity constraint study will be a very major contribution to the national well-being in that arena.

These are some examples, I think, of how we have dealt—how TRB has dealt in very sensitive areas to bring solid professional advice in what is very largely a political arena.

The third question that I will address is, Is the project study approach best? Certainly it is commonly used by TRB, and I will cite the program that has come to be known as the Strategic Highway Research Program as an example. This started within the Transportation Research Board as a study of the strategic transportation needs for the future for the country. Out of that evolved, first, the Strategic Highway Research Program, which is well along toward implementation, and more recently a strategic transit research project that is just now getting underway.

The Strategic Highway Research Program proposes a 5-year program of $30 million a year concentrating in just six technical areas: asphaltic concretes, cement concretes, bridge deck performance, snow and ice control, effective maintenance management, and long-term pavement performance. These areas targeted, again, for $30 million a year over a 5-year period, and we believe this will breathe new life into the business of building and maintaining the Nation's highways. Interestingly, this project which, as I said, started in the conventional mold, went over to the American Association of State Highway and Transportation Officials for a period, and is now coming back to the national academy for management and control, and we think that this flexibility in using various management approaches characterizes the academies. They show a great deal of flexibility in dealing with the problems that come along, and I think this is a commendable approach, a very necessary one.

No. 4, Should they have support for self-initiated studies? Very briefly, the TRB budget is a cooperative project in its own right, the support provided by Federal agencies and the 50 States, and there is some degree of freedom in that budget. But a large portion of the budget is dictated by specific mandated studies of the type I have just described, and, in general, I would argue that some degree of freedom in the budget area is necessary.

I am a firm supporter of the National Academy of Engineering's Technological Leadership Program, which was begun recently to enable and aid in performing more self-initiated studies. This program holds great potential to advance the Nation's industrial competitiveness, economic growth, and overall welfare by focusing on a spectrum of crucial issues, including engineering education and international technical exchange and cooperation.

Question No. 5, Should they have additional functions? I have already commented that the academies show a great deal of flexibility in finding ways to accommodate new challenges, and my sense is that that flexibility is so well demonstrated that they really adapt to the functions that come along within their broad charge in a very responsible way.

Question No. 6, How are they perceived by citizens? My answer is narrow in the sense that I am speaking for TRB, but there I can say just, without question, that this organization has unparalleled respect by the public and all of those in the transportation community in the United States and really worldwide. Continued public financial support for TRB is definitely in the Nation's best interest as the apparent public desire for technological innovation and the need for an unbiased organization to address citizens' transportation concerns would indicate. The prestige of TRB activities and accomplishments should strongly influence Government's use of and support for this organization. In an age where rigid organizational structures sometimes make innovation difficult, transportation agencies have forged a uniquely effective partnership with TRB. We all benefit from the fruits of this partnership. Innovation accelerates. Production increases. Quality improves. Good ideas spread, and problems get solved. TRB is an important key to making all of this happen in today's transportation business.

This concludes my testimony, Mr. Chairman. I am very strongly supportive of the work of the academies, and particularly of the NRC and TRB, and would be pleased to answer any questions that you might have.

[The prepared statement of Mr. Larson follows:]

U.S. HOUSE OF REPRESENTATIVES
TASK FORCE ON SCIENCE POLICY

HEARING ON
THE FUTURE OF THE NATIONAL ACADEMIES

May 6, 1986
Washington, D.C.

Testimony by

Thomas D. Larson, P.E., Secretary
Pennsylvania Department of Transportation
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Chairman Fuqua and other distinguished members of the Task Force on Science Policy, I am Thomas D. Larson, Secretary of Transportation for the Commonwealth of Pennsylvania and member of the National Academy of Engineering. I am pleased to respond to your invitation to share my views on the future role of the National Academies in providing scientific, technical and policy advice.

Being from the transportation community, I will focus my testimony on the National Research Council (NRC) and the Transportation Research Board (TRB), a unit of the NRC which addresses transportation issues. Your invitation to testify posed 12 specific questions for consideration. I have reviewed the questions and, as suggested, my statement will respond to those with which I can most directly relate. These are:

1. How have the academies fulfilled their Congressional mandate?
2. Are they effective in meeting the needs of government agencies and in addressing policy concerns?
3. Is the project-study approach best?
4. Should they have support for self-initiated studies?
5. Should they have additional functions?
6. How are they perceived by citizens?

HOW HAVE THE ACADEMIES FULFILLED THEIR CONGRESSIONAL MANDATE?

Clearly, the charge to "whenever called upon by any department of the government, investigate, examine, experiment and report upon any subject of science or art..." is a tall order. In my experience, TRB has responded in exemplary fashion to this formidable challenge. I will cite specific examples later, but first I have several general observations which give perspective to the valuable role which TRB plays in shaping the way we conduct this country's transportation business.

On more than one occasion, I have been puzzled by the misunderstanding that surrounds the scientific aspects of the transportation industry. After all, we've been building things like roads and bridges for many years, and some would believe that most all the technological possibilities would have been thoroughly explored by now. Nothing could be farther from the truth. Advances in the transportation field, from new and better materials and procedures, to creative financing mechanisms, to revolutions in information processing, to improved management techniques, are evolving at such a rapid rate that I suspect we have scarcely scratched the surface.

And these advances I speak of are not just "nice to have." In today's world it is essential that we innovate, and innovate with great zeal, with a passion, if you will. For unless we innovate and dramatically improve productivity and increase our ability to do more with less, we face the dire prospect of withering and dying in the world marketplace.

The monumental scope of the transportation challenge can be put in focus when one considers that the U.S. has millions of miles of air routes, roads, railroads, waterways and transit systems serving virtually every place that people live, work, shop or visit. Moreover, the provision of these transportation facilities and services must be coordinated with literally thousands of independent political units and interest groups; and the facilities and services we provide must not only be adequately designed and constructed, they must be safe, efficient, cost-effective and environmentally acceptable.

It is in this complex atmosphere of technological advances and of challenges to effectively apply new technology to better serve the transportation needs of America's citizens that the expertise provided by TRB is so critical. I want to briefly cover two aspects of TRB's activities which are particularly important in helping us put improved technology to work to meet changing public and political expectations.

o Cooperative Research Projects

TRB conducts an extensive cooperative research effort. Each of the fifty states, plus the District of Columbia and Puerto Rico, voluntarily contributes funds to the cooperative research programs each year to provide a pool of resources to address common problems which we all face. Candidate projects are solicited from highway organizations, and once each year state officials meet to select the top priority projects we want to work on. Typically, we select approximately twenty topics, and then TRB's volunteer panels select the best qualified research organization to work on each of them. TRB manages the research contractors, makes sure that the projects stay on track and produce results that are directly applicable to federal, state and local transportation programs, and distributes these results extensively among practicing agencies.

For example, one recent cooperative research project developed modern, technologically up-to-date specifications for elastometric bearings in bridges. Most of us drive over bridges without realizing that they even contain such a part, yet these rubber pads facilitate movement at the ends of bridge girders which, in turn, avoids structural distress and concrete cracking problems. The TRB study explored alternative designs and recommended appropriate standards for different types of facilities. The new specifications for elastometric bearings were quickly applied in practice through the widely-used design specifications adopted by the American Association of State Highway and Transportation Officials (AASHTO).

Similarly, TRB's cooperative research program has been valuable in cutting transit operating costs. For example, many of the nation's transit systems use small buses for part or all of their operations. The available products in this size range are highly diverse, as are the types of service that use them. Transit operators, faced with having only the bus manufacturers' specifications and performance claims upon which to base purchasing decisions, were experiencing great difficulty in selecting equipment that was most appropriate and economical for their particular application. To help alleviate this widespread difficulty, a TRB cooperative research project examined transit systems using different types of equipment, and collected extensive data on the performance of each type of equipment in various applications. These data were then used to formulate a process for estimating the life-cycle costs of alternative equipment in different applications, which allows transit agencies to tailor cost-effective solutions to their own particular equipment requirements. The industry's response was immediate and widespread. Hundreds of transit agencies requested information on the performance-based life-cycle-cost procedures, and many agencies are now making more economical equipment investment decisions as a result.

The TRB has also been a leader in compiling and publishing reference materials to facilitate the many engineering decisions which must be made about the design and construction of our transportation facilities. One of the most widely used of these is the Highway Capacity Manual, which provides analysis procedures for highway design and operational features. Use of these procedures enables transportation agencies to benefit from past research and experience and helps ensure that the facilities we build are safe, durable and cost-effective. Many of these procedures have subsequently been adopted as standards by AASHTO and the Federal Highway Administration. Given the many diverse agencies which are responsible for building and maintaining transportation facilities, guides such as the Highway Capacity Manual are invaluable in bringing a degree of uniformity into our business.

We have all heard the statistics that one worker in six in the United States is employed in transportation, and that some 15-20 percent of our GNP comes from transportation. These are enormous stakes. Just as important, though, is the role of transportation in preventing accidental death and injury, in maintaining a clean environment, and in shaping urban and regional development. Each of us, within recent memory, has seen dramatic changes in our transportation system; every aspect of this vast system has advanced, a step at a time, through progress made by individual states, through public and private sector developmental efforts, and through research programs. Indeed, the products of TRB's cooperative research programs have been one of the keys to this sustained progress, and I know that the widespread use of these products in Pennsylvania, and throughout the nation, has not only saved us hundreds of millions of dollars, but has also helped to make transportation more convenient, safer, and more supportive of environmental, social and economic objectives.

o Technology Transfer

The creation of innovative methods and products is crucial, but knowing they are available and knowing how to use them are just as important. In our highly decentralized industry, those of us working in any one transportation agency see only a small part of the total system. We often innovate and experiment extensively within our own domains, but even so, we can't possibly be involved in all that is going on in other agencies and programs. We use TRB as our window on the world to overcome this limitation. TRB's various programs promote the development of new concepts, processes, and materials. TRB has been around since the nation's highway program was preoccupied with digging the farmer out of the mud. We've done that and much more, and TRB has been such a positive force for progress that it's hard to find any major advance within our vast transportation system that TRB hasn't helped nurture and encourage.

To keep the decentralized transportation industry coordinated and current on all the safety, environmental, technical, legal, and administrative developments bearing on its work, TRB maintains some 170 standing committees on virtually every aspect of transportation, ranging from airport operations to traffic signal systems. The membership of these committees is drawn from some 3,000 professionals in all parts of the transportation industry, who volunteer their time and expertise. I strongly encourage my professional staff to participate actively in these committees. It helps keep us current on what's new, what works, and what doesn't.

Also, by maintaining volunteer committees with expertise in a wide range of technical specialties, TRB is poised to apply its technical expertise very quickly when conditions require. For example, during the process of designing the 1990 Census, TRB was asked to review the proposed transportation components. TRB quickly convened a group of knowledgeable professionals to examine needs, costs, and tradeoffs. A report describing their findings was prepared which will directly influence the design and usefulness of the next census.

Another very useful technology sharing tool provided by TRB is the Transportation Research Information System, a computer-based catalogue of ongoing and completed research in thousands of specialized transportation topics. The system enables transportation professionals to readily identify published material that can help us continue to innovate and advance. I encourage my staff to use the system to find information that will assist us in avoiding the mistakes others have made, in avoiding duplicate research and in learning from others' successes.

Perhaps the most direct example of TRB's commitment to technology transfer is the annual TRB meeting held each January in Washington, D.C. 4,500 professionals from throughout the country and from numerous foreign nations gather to spend four days in concentrated technical sessions on topics ranging from statewide rail systems planning techniques to routing shipments of hazardous materials. More than 900 technical papers and presentations are offered. Each year I send nearly 100 professionals from my staff to the TRB annual meeting. I can't think of a better opportunity for them to share Pennsylvania's experiences, to hear the latest transportation developments and, just as importantly, to interact and exchange ideas with their peers. I'm convinced that this sort of exposure stimulates meaningful research and fosters innovation. My colleagues in other states obviously agree; the annual TRB meeting is a major event on our transportation calendars.

Many of the technical presentations given at the annual meeting are also made available through TRB's extensive publications programs. TRB publications reach every major transportation agency in the U.S., more than 225 libraries, and approximately 8,000 practicing professionals. In recent years, TRB has expanded the media through which it makes technical information available to include teleconferencing, video cassettes and tape recordings.

Overall, TRB's cooperative research programs and its technology transfer activities are practical and effective mechanisms for bringing technical advice to bear on transportation decision-making. This advice is detailed and reliable. I don't know of any place where transportation agencies get more for their money than by working together through TRB. Clearly, TRB has fulfilled the mandate of Congress to the academies in a very responsible manner.

ARE THEY EFFECTIVE IN MEETING THE NEEDS OF GOVERNMENT AGENCIES AND IN ADDRESSING POLICY CONCERNS?

Increasingly, the process of building and operating our complex transportation systems involves both technical and policy considerations. Indeed, I believe that the key issues facing the transportation industry today cannot be resolved with technical solutions alone. We must fine-tune technical solutions within their political contexts. A distinguishing characteristic of TRB is that it provides the expertise and the forum necessary to present technical knowledge so that it can be understood and assessed within a highly charged political environment. Three recent instances can be cited.

First, in the Surface Transportation Assistance Act of 1982, Congress asked the NRC to assess the consequences of a national 55 mph speed limit. Bringing together safety specialists, statisticians, medical experts, traffic engineers and other professionals, TRB conducted the most detailed assessment ever done to evaluate the safety and energy conservation benefits of the 55 mph speed limit, as well as what it cost in additional driving time. Hundreds of analyses that had been done on the subject were reviewed, and the ramifications of different actions being considered by Congress were evaluated in detail. Although a specific policy was not recommended, Congress was provided the necessary facts and figures to deal with this politically sensitive issue.

Secondly, at the request of Congress, TRB recently reviewed the future professional staffing needs in government transportation agencies. This request stemmed from a concern that the surge in hiring of transportation professionals following World War II would soon result in exceptionally high rates of retirement and possible shortages of experienced professionals. TRB collected and analyzed profile data on professionals in federal, state and local transportation agencies. The results showed that while national shortages were unlikely, some state and local agencies could face severe problems. For example, in some states it was found that more than 40 percent of the professional work force would be eligible to retire within five years. TRB has drawn industry attention to this potential crisis and has provided agencies with valuable information to put their professional staffing needs in context and to convince their oversight bodies that exceptional anticipatory steps are required. As a result of the findings of this study, numerous agencies have become more sensitive to future staffing needs and are training, hiring and restructuring to meet those needs.

Thirdly, in recent years, as air traffic has increased and localities surrounding airports have become alarmed with the prospect of airport expansion, some have argued that airport terminal and landside facilities have exceeded capacity. At the same time, the Federal Aviation Administration anticipates a near doubling of air traffic over the next two decades and must assure that adequate airport and airway capacity is available when and where it is needed. The Federal Aviation Administration turned to TRB to develop guidelines for measuring landside capacity so that it can be consistent in any decisions it makes regarding airport capacity. I think that it was wise to call upon TRB's technical resources, institutional credibility and close communications with all levels of government to begin a dialogue on constructive solutions to airport landside capacity constraints.

These are but three examples of how TRB effectively brings scientific and technical information to bear on policy issues. Other organizations, public or private, would inevitably have some particular self-interest in a given issue and could not muster the independence, objectivity and reliability that TRB provides.

IS THE PROJECT-STUDY APPROACH BEST?

The project-study approach has proven extremely valuable in bringing diverse perspectives together around a common base of technical knowledge. TRB has applied this, as well as other approaches, to keep transportation agencies forward-looking and technically prepared. I would cite the evolution of the Strategic Highway Research Program (SHRP) as a case in point.

The nation's transportation research programs are frugal by comparison to those of most other industries. In the case of highways, less than one quarter of one percent of total expenditures are for research, far below what virtually every other industry spends. This current level of highway research is inadequate in many respects.

Faced with widespread concern over the deteriorating condition of the nation's transportation infrastructure, leading highway officials recognized a few years ago that we don't have all the technological know-how we need. Through TRB, they assembled highway professionals, industry researchers and academicians to review the situation. This group concluded that there were a number of critical problem areas that were too costly to be taken on by any of the existing organizations. Yet, the potential was identified to save hundreds of millions of dollars through technical innovations in these areas. The experts assembled through TRB pinpointed the problem areas, sketched a possible solution and helped AASHTO and the Federal Highway Administration move toward implementation of SHRP.

I have been personally involved in the SHRP effort, which holds enormous potential to improve the performance and efficiency of the nation's highways. This is anticipated to be a five-year program of about $30 million per year concentrating in six areas--asphalt, concrete, bridge decks, snow and ice control, effective maintenance techniques and a long-term pavement testing program. SHRP is now under the management of a board of directors appointed by the National Academy of Sciences. All that remains is for Congress to act on the funding, and there is every reason to be confident that action will occur to provide one quarter of one percent of federal-aid highway program funds for this national research effort and that we will breathe new life into the quest for innovation in the highway business.

So, the project-study approach is a valuable and unique one, but it is not the only way that the academies are providing technical input. For instance, two TRB activities that I mentioned earlier, cooperative research programs and technology transfer, do not fit the project-study mold. These programs diverge from the project-study approach due to some unique features of the nation's transportation agencies and the historical circumstances which have accompanied their evolution. In particular, because TRB grew up beside a highly professional federal agency, the Federal Highway Administration, and a strong forum of state officials, AASHTO, it has evolved over the decades into a unique technical resource. It has become an organizaion which pushes the frontiers of technical capability, quickly gets improved techniques into practice, brings its expertise objectively into public decision-making, and yet remains flexible enough to reshape itself in response to changing needs. To my observation, TRB emphasizes step-by-step technical advances rather than quantum leaps in technology. Such activities are not always the project-study ones that typify many NRC programs. But, through its painstaking attention to incremental advances, TRB is poised with the technical and organizational expertise to effectively address key issues involving fundamental public choices as they arise.

SHOULD THEY HAVE SUPPORT FOR SELF-INITIATED STUDIES?

The NRC and TRB certainly need to have the capacity to conduct self-initiated studies. In the long run, the objectivity and independence of these organizations will be enhanced if their expertise can be focused on the concerns of knowledgeable technical experts, regardless of whether or not government agencies are willing or able to finance activities to deal with these concerns. Some temporary corporate financial assistance for self-initiated studies has been gained during recent years, a portion of which has been directed to a visionary study of the changes which should be made in our transportation systems to assure the safety and mobility of older citizens. The study was undertaken with the recognition that the nation must plan now for the rapid growth in the population of older Americans that is anticipated over the next quarter century. This study could not have been launched without self-initiation capability, and I expect that the results of this effort will be an important catalyst in bringing together public and private interests to begin planning now for the changing transportation needs of tomorrow's population.

In a similar vein, I am a firm supporter of the National Academy of Engineering's (NAE) Technological Leadership Program which was begun recently to enable the NAE to perform more self-initiated studies. The program holds great potential to advance the nation's industrial competitiveness, economic growth and overall welfare by focusing on a spectrum of crucial issues including engineering education and international technical exchange and cooperation. I endorse the NAE's decision to seek corporate financial support for this venture.

SHOULD THEY HAVE ADDITIONAL FUNCTIONS?

The NRC and TRB have consistently exhibited the insight to add, delete and modify programs in response to changing requirements and have done so in close coordination with the agencies which rely on their support. The present functions of the organizations have evolved in concert with technological change, and I have no doubt that they will continue to do so. The Strategic Highway Research Program which I described earlier is a prime example. In this case, the NRC's mechanisms for independence, objectivity and quality are being applied to a large-scale, carefully focused project. The energy required to accomodate such a project, the disruptions it might cause to other ongoing programs, and the risks inherent in a project like this might understandably have discouraged any agency which was asked to house the program. Not so in this case. The NRC worked directly with the federal and state program sponsors to craft the best solution for organizing and managing the project. I am certain that, as in the case of the Strategic Highway Research Program, the NRC and TRB will react responsibly to changing transportation needs and conditions which emerge in the future and will have the flexibility and the vision to add those functions which best serve the public interest.

HOW ARE THEY PERCEIVED BY CITIZENS?

TRB enjoys unparalleled respect by the public and especially by those of us working in the transportation field who rely on its trustworthy expertise. Its reputation for excellence is literally known around the world. As I have had occasion to visit with transportation leaders from other nations, I am always impressed by the extent to which they depend on TRB for guidance, and I appreciate the confidence in American technological know-how that this relationship builds. More often than not, the libraries of foreign transportation agencies largely consist of TRB publications. Clearly, this evidence of confidence and respect establishes beyond a doubt the effectiveness of the organization and its importance to the transportation industry. It is inconceivable that the leadership of this industry would want to proceed without the technical expertise that TRB provides.

Continued public financial support of TRB is definitely in the nation's best interest, as the apparent public desire for technological innovation and the need for an unbiased organization to address citizens' transportation concerns would indicate. The prestige of TRB activities and accomplishments should strongly influence government's use of and support for this organization. In an age where rigid organizational structures sometimes make innovation difficult, transportation agencies have forged a uniquely effective partnership with TRB. We all benefit from the fruits of this partnership: innovation accelerates, productivity increases, quality improves, good ideas spread and problems get solved. TRB is an important key to making all this happen in today's transportation business.

This concludes my testimony, Mr. Chairman. I assure you of my full support to work with this task force and with the NRC and TRB to further the objectives of the academies. It has been a pleasure to be here today to speak in support of these important national efforts. I would be pleased to respond to any questions you may have.

DISCUSSION

Mr. **Fuqua**. Thank you very much, Mr. Larson, for particularly the insights you give us from a State utilizing the services of the academy.

How do the academy studies differ from other technical panels that you might have to review various subjects that come before the State Department of Transportation?

Mr. **Larson**. Probably the most notable difference is the intense concern for eliminating or balancing biases so that in an area that is, as I have said several times, politically charged, that biases that would be inappropriate and perhaps very destructive are, in fact, balanced and/or eliminated. I think that is the most notable difference.

Mr. **Fuqua**. I assume that you have within the National Association of Transportation Executives or whatever that group might be called—I'm sure there is a group?

Mr. **Larson**. Yes.

Mr. **Fuqua**. Suppose you have a technical panel made up of structural engineers, and you are talking about certain aspects of bridge construction. How does that interface with what the national academy could do? I guess I am being more specific rather than what the 55-mile speed limit might do or access to airports, as you mentioned, the FAA study. I am speaking about more technical aspects. Say, it is a new design of bridges that may come forth, and I am sure that all of the Departments of Transportation are very interested and have some of their technical expertise, not maybe necessarily yourself, but your top structural person serving on that.

Mr. **Larson**. Yes, I can give some specific examples. First of all, the association of the 50 States is known as AASHTO—the American Association of State Highway and Transportation Officials—sort of a big mouthful, but that association has a large number of technical functions—maintaining standards and assuring that bridges in Pennsylvania are comparable to bridges in California or wherever. So there are technical committees in AASHTO for bridge design, bridge inspection, and all of those things.

Those committees are very often served by the work of a project within the Transportation Research Board framework within the National Cooperative Research Program, and this project might be to develop a particular technical aspect that is then brought back to the committee of the 50 States on bridges and implemented through that process. So there is very close relationship, but the TRB function would be to flesh out a particular technical concept, and then bring it back for implementation through the policy committee of the 50 States.

There, a two-thirds vote of the 50 States is required before a policy change regarding any technical matter or policy matter of any kind is in fact adopted as policy for the Nation.

Mr. **Fuqua**. Well, that brings up another question. The type of advice that you get from the academies for the transportation sector, I am speaking of, is it primarily basic science, or is it more technically ready for implementation?

Mr. **Larson**. I think that, in general, we seek information that is relatively close to being implementable. We are not basic scientists in general. Our mission is a very applied mission, but let me say that we recognize the need for much more basic guidance, and in the Strategic Highway Research Program that I mentioned, one of the most important components is a more comprehensive understanding of asphaltic cements, a very mundane material—a byproduct really of petroleum production—but we buy it in huge quantities so that just a very minor change in the cost or the performance can lead to billions and billions of dollars of savings. So there we are looking for very basic information, and under the auspices of the national academy we will be launching a $50 million effort that is in quite large part a very basic study of this material.

Mr. FUQUA. Do the States contribute to that payment or the Federal Highway Administration?

Mr. LARSON. The payment is really from the people. We use Federal funds as part of our State funding package, each of the 50 States, and the planned funding for this $150 million would be to set aside a portion of the Federal allocation to each of the States so that it would form a pool over the 5 years to provide this $150 million. So it really is all the taxpayers funding this through a cooperative venture.

The funding, by the way, is being advanced in the funding proposals for the reauthorization of the transportation legislation that is due this fall.

Mr. FUQUA. Do they do studies, which I am sure is of great interest in your State, because we have had members of Pennsylvania on this committee that have expressed a great deal of interest, and that is corrosion and rust?

Mr. LARSON. In the Strategic Highway Research Program, one of the major components is snow and ice control. Certainly, it is the hope of all but just a few States—I think there are seven States that essentially use no deicing chemicals. All the rest of the States are faced with using sodium and calcium chloride, and while they are relatively effective and demanded by the public, they have very major side effects that I could describe at great length, and so, yes, there is a major component of this effort that would look at finding new ways of dealing with this problem.

Hopefully, there are going to be some innovative ways that go beyond our conventional knowledge, and it will depend on very basic discoveries in science.

Mr. FUQUA. Will that eliminate potholes?

Mr. LARSON. Probably not.

Mr. FUQUA. Mr. Lundine.

Mr. LUNDINE. I have no questions.

Mr. FUQUA. Mr. Packard.

Mr. PACKARD. Just one question, Mr. Chairman, I suppose, and it is a general question. We have made significant advances technologically in this country in many, many areas—biomedical areas and space research and aeronautical research and in several areas we have made remarkable progress. In transportation issues, the average American person doesn't see all that much change in technology. We still are using the same bridges and the same roads and have the same basic problems that we have lived with for years and years. In the early part of your statement, you mentioned how that we have only scratched the surface in using science and research to make advances technologically in transportation.

It is hard to see that. It is hard to see where we are going to get much different. The automobile hasn't changed that much. Our modes of transportation are not that much different. As a child, I remember Buck Rogers and seeing all of the things that we now are seeing have come to fruition. We don't see our roads built with automated systems where they can guide a car down without a driver or something like, as children, we envision possible.

Mr. FUQUA. Some of them do that, but they are not supposed to.

Mr. PACKARD. They are not supposed to do. They are on automatic pilot, but they are not supposed to be.

Do you see our transportation system changing radically from what we have traditionally become used to?

Mr. LARSON. Well, Mr. Packard, I said in my opening remarks that everybody is an expert in this business, and since everybody is an expert no one really perceives change, but let me assure that change is in fact occurring, and I think at a pretty dramatic rate.

Two technologies that have certainly changed transportation within our lifetimes are freeways and jet engines. Now, they haven't changed overnight, but certainly the jet airplane has changed the world in more dramatic ways than almost anything you can name. My mother was born on a subsistence farm in Pennsylvania, and lived to fly halfway around the world on a jet airplane. Now how fast does change have to come I'm not sure, but certainly that is truly dramatic.

Freeways really started with the Interstate Act, President Eisenhower. Many of us can remember that era in 1965 and have changed the habits. Last week I was in Atlanta and took a helicopter trip over the city of Atlanta, and Atlanta is a city shaped by the technology of the freeway just without question, and many of the rest of our cities are. That just happens to be my most recent example from the air.

Containerization—dramatic changes in the way we move goods. Most of us can remember the long shoreman issue in ports. Now containers have just dramatically changed the way we move things worldwide. And computer management—in Pennsylvania a decade ago we had 23,000 employees in the Department of Transportation; we now have 12,600 and going down, and the difference is that we are managing huge systems with modern information technology, doing things that were just totally unheard of 4 or 5 years ago with new systems.

The automobile you say hasn't changed. When I came into office 7½ years ago, the average mileage was 13 miles per gallon. It is now approaching 25 by congressional mandate, and the automobile has been totally redone in that period. The big finned behemoth that populated our highways a decade ago is by and large gone, and we have a streamlined, much more fuel efficient vehicle made with totally new materials. I am a witness of the lack of the steel industry in Pittsburgh to make my point. So the automobile is a whole new creature.

Roads—in Pennsylvania we are now using technology that is close to Buck Rogers. We pick up a road, reprocess it, and put it back down, adding new chemicals to it and come out with a surface that is newly improved and free of those terrible things called potholes. And I could go on for as much time as you want to have me here, but I would say that our industry is, again—or our business is one that is known by everybody, so it is disdained by everybody. What is well-known is typically a subject of disdain, but in fact it is an area where there are remarkable advances being made every day.

Mr. PACKARD. An interesting followup question would be what effect does the technological advances we are making in transportation, particularly on our highways have to do with the 55-mile speed zone? But that is a hearing of another type I think.

Mr. LARSON. I would be glad to come back for that one, sir.

Mr. PACKARD. As a transportation leader in the State of Pennsylvania, what is your feeling about rural interstates and the advances we have made in the freeway system and in the automobile relative to safety and speed limits?

Mr. LARSON. Well, clearly we have provided a system that has design features for speeds above 55 miles an hour. I believe, however, that we have not provided a set of drivers that have all the skills necessary for those higher speeds and am firmly committed to the 55 as a safe and prudent speed limit.

Mr. FUQUA. Thank you very much, Dr. Larson. I think we will get you out of here on time. Thank you for being here this morning.

Mr. LARSON. Thank you very much.

Mr. FUQUA. Our next witness will be Dr. James B. Wyngaarden, the Director of the National Institutes of Health. We are glad to have you back here once again. You have made many appearances before the committee, and we thank you for joining us this morning.

STATEMENT OF DR. JAMES B. WYNGAARDEN, DIRECTOR, NATIONAL INSTITUTES OF HEALTH, BETHESDA, MD

Dr. WYNGAARDEN. Thank you very much, Mr. Chairman. It is a pleasure to appear before your committee once again on this topic. I am appearing as the Director, but I do not have a prepared statement. Unfortunately, I was out of the country at the time the request arrived, and we didn't have time to go through the necessary clearance process to do that, but I do have some remarks that I will make.

As you pointed out earlier, I am a member of both the National Academy of Sciences and the Institute of Medicine and have, from time to time, served on various NAS and IOM committees dealing with life sciences, research manpower development, Government industry, university relationships and the like, but I will disassociate myself from that role and speak as the Director of the NIH this morning.

I thought in doing so it might be most expeditious if I commented sequentially on the questions that you originally submitted, and the first of these deals with the question of whether the academies have fulfilled their original mandate. Certainly with respect to the National Institutes of Health we would give that a resounding, yes, they have responded to investigate and examine the subject of science as we have requested this of them, and indeed we are a very heavy user of the Academy and of the IOM.

In the past 2 or 3 years alone we have perhaps close to 100 contracts and projects that they have undertaken for us, and they have almost without exception replied in a timely and authoritative manner. The prestigious standing of the academy, the wisdom of its members brought experience of, I guarantee, a very high quality to these.

We have had relatively little occasion to call on the National Academy of Engineering. There are a few examples, but just a few, so that my comments are essentially restricted to the other two components, and of course the NRC, which serves them all. The charter also allows for experiments and reports, but we have not, to my knowledge, called on the academy to conduct true experiments.

Within the last couple of years, the academy declined to participate in one study because the study required the acquisition of new information, and they felt they were not well positioned to acquire new information. That is one minor exception to my otherwise global statement about responsiveness. In another recent experience, the report anticipated was not forthcoming because the academy, in its review process, could not achieve a scientific consensus with the members of the reporting committee on the subject of recommended daily allowances of vitamins and minerals in the diet. That will occasionally occur when scientists look at data and reach some different conclusions as to its interpretation. But for those minor exceptions, I would otherwise say that the response has been superb and extremely valuable.

You asked in what manner and how effectively the advice meets the needs of Government, and whether their process or utilization will change. Because the policy issues are becoming increasingly complex, the development of useful and productive recommendations may, in the future, require some shift in the manner of interaction. For example, a more collaborative mode of operation between the academy and the sponsoring agencies would on occasion be advantageous.

Once a project has begun, the agency's role at present is really quite limited. In the instance to which I referred on the nutrition study, I think that ongoing interaction of a more collaborative nature between the contractor and the academy might have been advantageous, and we are discussing this with the academy, but with that exception, I don't see a major change in the manner of proceeding.

In a few instances we have sought scientific advice from the academy, but since we are an agency of science ourselves, our need is usually for policy recommendations that affect science or for centralized data bases, for example, a doctorate record file for some of our studies. Some of the academy projects have been initiated by us—I'd say the majority—for example, in 1984 a study of the organizational structure of NIH and others have been mandated by Congress, for example, the continuing study of the personnel needs for biomedical and behavioral research, which was mandated in 1974 by the revision of the Public Health Service Act at that time.

The advice provided by the academy scientists usually meets our needs, and the information compiled reaches a much wider audience than just NIH as many of these reports become public. There is some variability in the effectiveness and manner with which the projects are planned and carried out, but a centralized academy report review process tends to smooth this out. In my view, that process is stronger within the National Academy of Sciences than it may be in the Institute of Medicine, but that is also improving.

The advice of the academy does not come cheaply, and in this era of fiscal constraint, economies may not permit us to seek Academy advice as frequently in the future as in the recent past.

The next question asks whether the academy should attempt to speak with one voice. That is, I suppose, a desirable goal—not always attainable. The academy reaches a reasonable harmony among its various and several voices. From time to time, there may be fundamental disagreements on the interpretation of scientific data, but as I have indicated, that is really quite rare. For the most part, I think the academy has met the responsibility of speaking as an institution very effectively.

You asked whether the mix of advisory bodies presently available and called upon by Government is adequate or whether there should be some change there. I have already suggested that the complexity may require some different approaches in the future, but I think I would stress the fact, that regarding scientific advice, the academy has achieved a unique niche. It chooses not to compete with commercial providers of policy and management studies, and there have been occasions that we might have wished that some of our general solicitations had developed competition and might have attracted the interest of the academy. But there are many other organizations also involved in providing policy studies and overviews and forecasts, such as the OTA and the CBO and OSTP. There is a need for all of these, and also for such things as special commissions at one time or another, such as the one that investigated the Three Mile Island accident.

We are pleased to have direct access to the capabilities of the academy and certainly look forward to the continuation of those. There is a question posed about whether the charter mechanism is adequate or whether there should be separate charters. I agree very much with George Keyworth's statement—I would strongly favor a continuation of a single charter. It seems to me that the quality and prestige of the academy are such that they lend a certain amount of protection and authority to the work of the other academies. A single council of outstanding scientists insures that the policies of the constituent bodies are very much the same.

The next question deals with the project study approach, or whether other mechanisms should also be considered. From the organizational standpoint, the project study approach has met our needs very well. This approach may have higher startup costs than perhaps would be true if more standing committees existed. On the other hand, standing committees might not meet the needs of a particular study quite so well as the ad hoc committees because the specialized expertise and balance needed to address specific issues might not exist in a standing committee. That need perhaps might be partially met by rotating memberships of standing committees, but, in general, I would say that the project study approach has met our needs very well.

Should the Government take any steps to augment the ability of the academy to initiate their own studies? That is a complex issue. In the recent past, however, since Dr. Thier has assumed the presidency of the Institute of Medicine, they have undertaken, on their own initiative, a series of studies with their own funds. One ongoing one is looking at the policies in research and care in AIDS. In addition, Dr. Thier is very determined that the studies be conducted in real time and that the conclusions and advice of the studies be available perhaps within 6 months rather than 18 months, so that the timeliness is greatly improved.

I am pleased to see that they have undertaken that. On the other hand, I am also very much aware that the financial security of the academy could be greatly improved. They are in need of a much larger endowment if they are going to continue to initiate studies on their own without seeking outside funds for that. Whether the Government should be the source of that, I leave to the committee. I think, from the standpoint of the NIH, we would use our funds judiciously in the support of individual studies as they pertain to our particular needs at that time.

To what extent should the academy incorporate policy concerns into their recommendations? We, of course, strongly support the general statement that they should be fully familiar with the policy issues, but not necessarily bound by them. I think thorough familiarity with policy recommendations will increase the practical utility of the advice the academy provides. But the academy should, in my view, continue to be a fully independent body, and able to speak from its own scientific vantage point. We in turn should be cognizant of the recommendations of the academy, but not necessarily bound by those, either. I think that relative degrees of freedom on both sides are essential to an effective interaction.

How well do the academy policy committees function and provide balanced, relevant and timely advice? Over the long term the policy committees such as the Committee on Science, Engineering and Public Policy, the Government-Industry-University Round Table, Board and Health Science Policy Committee have served a very important purpose in providing a forum for the development of sound policy. There are times when we might have wished that they had provided more specific advice, or might have been willing to engage in studies that involve the acquisition of some new information. However, I suppose to that extent there is a limit to the function of the academy in preparation of reports. But I would say those are minor matters and that the greatest value that they do provide is in bringing scholarship to the evaluation of existing information.

You ask what effect a series of disciplinary studies in individual fields of science have had? Let me cite one example. The recent Pimentel report on chemistry called attention to the prominent role that this discipline is playing in the health sciences. It revealed, for example, that some 22 percent of university chemistry departmental research is funded by the NIH. It also offered reasons why the average NIH grant should be larger. It provided valuable information on the status of chemistry research instrumentation just at the time when we were reviewing the instrumentation question generally, so that rather sharply focused advice produced some valuable information for us. There is a current study underway, "Research Opportunities in Biology," that we hope will be equally useful.

Are there functions the academy should be serving? I don't have any suggestions of bold new functions? I think I would draw once again on the matter of collaborative interaction, which I think might be somewhat improved, and now again the willingness to engage in some original data collection and development of new information might broaden the scope and value of reports, but I think those are minor adjustments if they could be considered.

Finally, what is the perception of the academies and their roles vis-a-vis citizens of the country, and to what extent should that factor play a role in the Government's use and support of the academies? I think the citizens of the country, in general, view the National Academy of Sciences as a kind of a Supreme Court in the sciences; somewhat remote, highly respected, trusted. I think the IOM may achieve that status with time, although it is a much younger organization.

These circumstances encourage Government to use academy capabilities. I think they militate strongly against the dilution of the Academy committees by appointment of lay members who might be there for specific, social, political or policy purposes.

This interface between Government and the academies should be characterized by mutual respect and collegial effort to solve national problems in science policy, but I think the academies must be free to criticize Government policy. Otherwise they can't really serve the national interest. At the same time, they must be held to an extremely high standard of performance, again, in the national interest, and I think that is the case.

There is, of course the obvious statement that the scientists themselves are citizens, and therefore their civic responsibilities, I think, influence the recommendations on focused issues. I think the academy reports do demonstrate an awareness and respect for the concerns of the American public, as well as the needs of American science. As you can tell, I am a great admirer of the academy.

Thank you, Mr. Chairman.

DISCUSSION

Mr. FUQUA. Thank you very much. You mentioned briefly about the Academy starting self-initiating studies. Do you think that would have an impact on some of the funded studies that they may have, or may be requested to do?

Dr. WYNGAARDEN. Yes, I suspect it would. I don't know a great deal about the financing of the academies, but it has been my impression that at times studies have involved a mix of contract funds and Academy resources, and obviously if they draw heavily on their internal funds for self-initiated studies, it will provide less flexibility for other purposes. I do know the question of building an endowment is very much on the minds of both Frank Press and Sam Thier.

Mr. **Fuqua**. I know that NIH has used the studies in the past, and I am sure you will continue to use them in the future, but do you see any increase or decrease in the utilization of the academies to provide similar advice to organizations such as NIH in the future?

Dr. **Wyngaarden**. I think the only limitation would be the resources. Academy studies, as I mentioned, do tend to be quite expensive, therefore we consider carefully whether a particular issue should be addressed in that manner. There is often a considerable negotiation as to the cost, the study, and the scope of the study before an agreement is finally reached. So I think that the possibility that we would use them less in the future would be dictated primarily by resources. We certainly have need of their services and continued activities in studies and issuance of reports, and we will continue to use them heavily.

Mr. **Fuqua**. Getting back to the first question I asked about self-initiating studies, would you advise the Government not to augment the ability of the academy to further implement self-initiated studies?

Dr. **Wyngaarden**. I am not certain I would do that. I think the point I would stress is that the independence of the academy is precious, and if the general idea of support from Government in any way compromised that independence, I think it might not be desirable.

Mr. **Fuqua**. The academy conducts a lot of health-related studies for a lot of different agencies other than NIH—for EPA and the Food and Drug Administration, the Department of Defense and some others. Does this diversity of health advice cause any problem for NIH?

Dr. **Wyngaarden**. I really can't think of any example, Mr. Chairman. I don't believe so.

Mr. **Fuqua**. Mr. Packard.

Mr. **Packard**. One question relating to the cutback of funds that seems to be almost obvious in the future. How will that affect your service and your relationship with the academies and the contractual arrangements, and where do you see the priorities in terms of those cuts going?

Dr. **Wyngaarden**. Well, we have had one experience with that this year, of course, with impact of the Deficit Reduction Act. That created rather substantial strains internally because there are certain internal costs such as personnel salaries and the operation of the clinical center, which is essentially the hospital, that can't be tuned down on short notice. Longer term adjustments might be possible. I think that for that reason, in such a situation, we would have fewer flexible dollars for studies.

On the other hand, we have a required set-aside for evaluation studies, and some of those funds finance studies done by the academy so that there would always be some funds available for ongoing studies.

Mr. **Packard**. Do you think that there would be a move more to try to acquire, or to adopt studies that are funded by private sector, or would you simply see a cutback in the studies?

Dr. **Wyngaarden**. I would think there would be some cutback if the constraints continued, and probably of both—both the academy and contract agencies or companies.

Mr. **Packard**. Do we find very many studies that are duplicative in terms of studies that are being done by other agencies or by the private sector?

Dr. **Wyngaarden**. No. I think there are many examples in which we learn of a study being conducted by some other agency—frequently the NSF, in which we find that by joining with them, adding some resources, broadening the scope somewhat, that we can piggy-back, as it were, and find valuable information for both of our purposes in that manner. Frequently studies of graduate science departments, for example, can be broadened to include those in medical schools, and I suspect with some savings as a result. I don't know of any duplications that I could cite now.

Mr. **Packard**. Thank you, Mr. Chairman.

Mr. **Fuqua**. One final question: if the academy funded a project with non-Federal sources and a report came from that, should the sources of funds be identified?

Dr. **Wyngaarden**. My first response without having thought that through is, yes. I think that would be very important. I think we want to be very clear that objectivity of the academy is maintained. That is one of its great virtues and high prized, and that should never be tainted by the source of funding for particular studies, it would seem to me.

Mr. **Fuqua**. Dr. Wyngaarden, thank you very much.

Dr. **Wyngaarden**. Yes, sir. Thank you, Mr. Chairman.

Mr. **Fuqua**. Our last witness this morning will be Dr. R. Duncan Luce, Department of Psychology and Social Relations at Harvard University. Dr. Luce, thank you for joining us this morning.

STATEMENT OF DR. R. DUNCAN LUCE, VICTOR S. THOMAS PROFESSOR OF PSYCHOLOGY, HARVARD UNIVERSITY, CAMBRIDGE, MA

Dr. **Luce**. Thank you, Mr. Chairman. I come to you with a somewhat different perspective than the preceding speakers, and that is reflected in my testimony. First of all, I am principally a working scientist, a professor, and that is my main source of income. On the other hand, I am a member of the National Academy of Sciences, and I have been active in its affairs. For instance, I have been involved in both the operation of the academy itself and of the National Research Council.

In the academy, I am currently the chairman of more than 180 elected members, out of a total of 1,450, who are behavioral and social scientists. Before that, I chaired the section in psychology. In the National Research Council, I served from 1973 until 1979 as a member and then as chair of what is now called the Commission on Behavioral and Social Sciences and Education, one of the four explicitly disciplinary branches of the NRC. Since 1982 I have been a member of the Report Review Committee, which is composed of members of the three institutions. This committee supervises the review of every report emanating from CBASSE and from every other branch of the NRC. Its role is quality control, and it is advisory to the Chairman of the NRC, who ultimately decides whether or not a report satisfies NRC standards. Since 1984, I have been co-chairman of the Committee on Basic Research in the Behavioral and Social Sciences, one of the 40 report-writing units under the supervision of CBASSE. That committee is now completing a 10-year outlook study for the National Science Foundation and other public and private agencies. With my co-chair, Professor Neil Smelser of the University of California at Berkeley, I gave testimony to this task force last September, based largely on that project.

Let me add that, like the 8,000 scientists who participate annually in these activities in the complex, I do not make any fraction of my living from these activities. Each of us performs them on a voluntary, part-time, wholly unpaid basis. The reasons why we devote so much time to these organizations and what I have learned about them in the last decade and a half are what my testimony is about.

I wish to cover four main points. First, I will outline briefly what I consider to be some of the unique features of the Academy complex for providing advice to the Government. Next, I will briefly review the history behind the relatively recent emergence of the behavioral and social sciences as important components of the academy complex—both in membership in the academy, in the increasing role of CBASSE in the NRC, and of these sciences in committees of other branches of the NRC. Third, I will cite several recent CBASSE reports which typify the kinds of work presently underway. And finally, I will discuss my sense of future opportunities for Government to draw on the behavioral and social sciences.

The academies, as you know, consist of a highly select group of scientists who, in the eyes of experts in their own field have made major contributions. From the point of the scientists, it is a high honor to be elected to these organizations. Because the academies have stature and take very seriously the responsibility embodied in the charter, they have been able to make the NRC work as it does. It seems to me that NRC has the following kinds of features:

It is able to call upon in a highly organized and systematic way the entire U.S. scientific community to provide its knowledge and advice on a voluntary basis.

Second, it commands worldwide prestige and, in a country that has no centralized scientific establishment, it provides a natural voice for dealing with the scientific establishments of other nations.

Third, it endeavors to build consensus about science-related policy issues, while at the same time allowing for dissent when complete consensus proves impossible.

It arranges, on a daily basis, for people from all relevant disciplines—physical, biological, engineering, social, and behavioral sciences—to work together on tasks having major scientific and engineering components. The ability to identify the best experts in the country rests upon having in place a well-run, standing structure that knows how to take into account the multiple disciplines and points of view needed to construct committees that are seen, by reasonable people, as both expert and balanced.

It takes on primarily those controversial problems that do not admit simple technical answers, but rather those that lie at the complex interface of several disciplines and which require the marshaling of existing scientific evidence and the assessment of its implications for public policy conclusions. It typically shuns those problems that are better carried out by a data-collecting organization or by a professional consulting firm.

It has a uniquely defined role relative to Government, while at the same time it maintains the prestige, independence, and objectivity that permit it generally to resist pressures from either private or Government sources. This leads it to have an unusual degree of credibility with the public, with Government, and with the scientific community.

It is responsible to the Nation. As the late Philip Handler, then president of the NAS, wrote ". . . it is the changing agenda of the American people that shapes the agenda of the National Research Council."

It is deeply concerned with quality control over its reports, and it maintains sufficient collegial respect in the science and technology community to carry out very serious reviews which often lead to considerable restructuring of reports.

In short, if this structure did not now exist, someone would have to invent it.

Let me briefly talk about the roles of the behavioral and social sciences in the NAS. NAS, as you recall, was chartered in 1863, and shortly after that a section on anthropology was established, and in 1911 psychology was added. During World War I, it was recognized that the relatively few members of the, by then, highly honorific NAS simply could not, by themselves, provide all of the advice requested by the Government, which led then to the creation of the NRC.

By the Second World War, the role of psychologists and anthropologists had greatly increased and the NRC established standing committees, for instance, on vision and hearing. During the 1960's, after prolonged debate, a major decision was reached to incorporate the other branches of the social sciences into academy membership. New sections in economics and in the social and political sciences were created, and in the first 5 years a special effort was undertaken to elect to the NAS the Nation's most distinguished behavioral and social scientists. As I said earlier, over 180 such scientists are now members.

In 1973, the NRC was reorganized, creating four major disciplinary divisions, one concerned solely with the behavioral and social sciences. Program expenditures by the forerunner of CBASSE were about $1 million by 1975 and are expected to exceed $6 million in fiscal year 1987, which is about 15 percent of the total spent on studies in the NRC. This figure does not take into account the fact that many of the committees in other parts of the NRC include behavioral and social scientists, a point to which I will return in a moment.

Behavioral and social science contributions to the work of the NRC fall into two distinct categories: studies housed in CBASSE on major social or behavioral issues that are addressed principally by these disciplines; and, those providing research expertise to studies being carried out in other parts of the NRC, but which draw on a behavioral or social science as part of their technical knowledge base. Let me, briefly, give you some examples of each type of activity, beginning with several recent reports on major social issues.

In early March of this year, CBASSE's Committee on Population released a major report on the relationship between population growth and economic development. Prepared at the request of the U.S. Agency for International Development, and with additional support from the Rockefeller and Hewlett Foundations, this report addresses an issue that has become central to the debate about U.S. assistance for family planning and other population-related programs in the developing world, namely: does rapid population growth have a positive or negative impact on economic development? In the late 1960's and early 1970's the answer to that question was taken for granted—reducing the rate of population increase in developing world was considered essential for economic and social development in the Third World. In recent years, that assumption, along with U.S. programs aimed at reducing population growth rates around the world, has been strongly challenged.

After careful examination of the existing data, the Committee on Population affirmed that slower population growth does, in fact, have a positive impact on economic development under most circumstances, although a reduction in fertility, by itself, is not enough to ensure economic growth. The committee also concluded that family planning services do have a positive effect on individuals and families, including, especially, the health and welfare of children. This report has been extremely well received by experts on all sides of these issue and seems likely to become a major point of reference for policymakers in the years ahead.

Like almost all NRC reports, this one did not entail collection of new data. The role of such committees is to review, evaluate, synthesize, and summarize what is currently available. More often than not, there is controversy over the quality and meaning of existing data, and usually ideas for collecting more useful data emerge, almost automatically, as part of the deliberations. One task of the committee is to attempt, in spite of incomplete information, to reach the best consensus that it can on the basis of what is available. Such development of scientific consensus—which does not mean rigidity, for it may well be modified as more information is acquired—is a major activity of the academy complex.

I will skip over some of the examples that are in the written testimony in order to be brief. Let me take up a different kind of report that represents one of the nuts-and-bolts roles of the NRC, playing its role as advisor to technical Government agencies. This is "The Bicentennial Census: New Directions for Methodology in the 1990's." In preparing for the twentieth national population count, the Census Bureau has a limited amount of time and very limited budget to test and evaluate new methods and new technologies that might make the census less expensive, more accurate, and more effective in its many uses. These, you recall, include apportioning and districting seats in the House of Representatives and State legislatures, allocating $80 billion in Federal formula grants, planning local services, public works, commercial and industrial siting decisions, and corporate marketing strategies.

In this 1985 report, a CBASSE panel developed priority objectives and recommendations for vigorous research on procedures to improve the coverage and to measure the completeness of the 1990 census, on the use of sampling and computer matching of administrative records, and adjustment of undercounts, overcounts and related measurement of population characteristics. The report also recommends pilot experiments that will begin the transition to 21st century census methods, which probably will differ as much from those of the present day as these do from the techniques of the 19th century.

As a final example, in response to a request from the National Institute for Occupational Safety and Health, the Committee on Vision undertook a critical review of the scientific evidence regarding the impact of occupational video viewing, for example, working at a personal computer screen, on the vision of workers. Its report, released in 1983, has become the classic reference in this field, and one of the most widely cited reports ever produced by the Academy. The panel concluded that there is simply no evidence to support the frequently heard claims that working at video display terminals causes physical damage to the eye—for example, cataracts—or any other major physical problem—for example, miscarriages. The report does note that oft reported complaints of fatigue, stress, headaches, and so forth are probably the result of a combination of characteristics of the job itself and or ergonomic considerations in the arrangement of the equipment and furniture, and therefore something that is easily corrected.

I have given you necessarily brief descriptions of a small sample of recent studies of major social and behavioral issues. I have with me copies for the task force of each of these reports, as well as a list of all recent reports from CBASSE.

In the coming months you will see new reports on such important topics as adolescent pregnancy and child-bearing, factors affecting taxpayer compliance and the research needed to understand this phenomenon better, and techniques for the enhancement of human performance. You will receive, in due course, the results of a study on quality-control systems in the management of welfare programs legislatively mandated by this Congress, which is being conducted by a newly created panel of the Committee on National Statistics.

Another forthcoming report that I believe will be of special interest to this committee is the 10-year outlook previously mentioned, and about which Professor Smelser and I testified last September. It is the latest of a series of earlier reports, two of which I also have for the committee; namely, "Behavioral and Social Science: A National Resource" and "Behavioral and Social Science: Fifty Years of Discovery."

A few general remarks may be in order about what I perceive to be the major value and role of such reports. They afford an opportunity both to the scientific and funding communities to examine the current state of basic research, to assess new directions, and to propose changes in the arrangements so as better to foster the best work. Once again, part of what is involved is the development of consensus among scientists about what is good work and how to ensure that it is adequately supported. The development of consensus, as you well know, can be a very slow, time-consuming business. In this case, it has involved a questionnaire sent to 2,500 scientists, 31 subpanels of, on average, 8 members each, as well as the main committee of 22 diverse scientists.

Finally, with regard to the work of behavioral and social scientists within the academy and the National Research Council, let me note that many studies conducted by other divisions of the NRC both benefit from and in some instances, require the expertise of social and behavioral scientists. A good recent example is the congressionally mandated study of the 55-mile-per-hour speed limit, conducted by a special committee formed within the NRC's Transportation Research Board. It was clear from the outset of this work that many of the issues the study committee would have to address were social or behavioral in character—from cost-benefit analyses of the tradeoffs between time and money saved on the one hand and lives that might be lost, on the other hand, to understanding of the factors that cause drivers to comply or not comply with posted speed limits. Similarly, behavioral and social scientists have been involved regularly in the very large number of studies carried out by the NRC on environmental issues and requiring cost-risk-benefit analyses. It has often been left to the social scientists, for example, to tackle the most difficult component of such tradeoffs: namely, the measurement of benefits, which, like clean air, or quiet, or acid-free lakes, are highly subjective. We know it costs roughly $1 million to retrofit a 727 to make it significantly quieter on takeoff, but how much is a quieter environment worth. Even more important than their contributions to specific studies, the presence of behavioral and social scientists in the academy and the NRC ensures that questions about the social impact of technologies will always be asked, if not always answered to everyone's satisfaction.

Behavioral and social scientists also form a large and important complement of the membership as well as the professional staff of the Institute of Medicine, where they have contributed to major reports on such matters as nursing home regulation, improving Secret Service protection, and the growth of large-scale for-profit medical corporations, as well as congressionally mandated annual reports on personnel needs and fellowship programs for biomedical and behavioral research. Also, the Academy of Engineering has called on social scientists for key contributions to its important symposia on technological change and international industrial competition.

In conclusion, let me say that I think we are all acutely aware of the enormous changes, both technological and social, that are taking place rapidly throughout the world. It is manifest that these changes have unprecedented impacts on individuals, on various groups of people, on nations, and on the relations among nations. To be sure, some of these impacts are largely technical in origin and the resulting problems have technical fixes, but such cases are really very rare. The vast majority of the changes and resulting problems are a blend of technological and human aspects, and to ignore the latter is fraught with terrible dangers. The reactions of people to technical matters are often at least as important as the technical aspects themselves—witness *Challenger,* Chernobyl, acid rain, earthquake predictions, to name only a few recent and prominent ones.

Often the Government appears to think otherwise, to act as if it is sufficient to fund physical and biological scientists and to ask only them for advice. That, I would urge, is a mistake, one that almost two decades ago was recognized by the NAS when it added materially to the behavioral and social science strength of the NRC. I urge the Congress to take advantage of such scientific resources, both in the NAS and in the NRC and elsewhere, not with the idea of finding quick fixes to complex social problems but with the idea of getting as sophisticated, dispassionate advice as possible about what we already know and how we can learn more that is relevant to the problem. Gradually, that knowledge will affect what we do, as it has in some of the examples I have mentioned.

Thank you and I will try to respond to any comments or any questions.

[The prepared statement of Dr. Luce follows:]

Statement of R. Duncan Luce

Victor S. Thomas Professor of Psychology

Harvard University

Cambridge, MA 02138

before

Committee on Science and Technology

U.S. House of Representatives

Tuesday, May 6, 1986

Mr. Chairman and members of the Task Force:

My name is R. Duncan Luce, and I currently hold the Victor S. Thomas chair in psychology at Harvard University. Since receiving a doctorate in mathematics from MIT in 1950, my professional career has largely been devoted to developing and experimentally testing mathematical theories of mental processes and behavior, especially in the areas of choice, decision making, measurement, information processing, and sensory processes, mainly hearing. Over 36 years, I have held research and teaching appointments at MIT, Columbia University, the Center for Advanced Study in the Behavioral Sciences at Stanford, the University of Pennsylvania, the Institute for Advanced Study at Princeton, the University of California at Irvine, and the AT&T Bell Laboratories. So I speak to you principally from the perspective of a working scientist and professor, those being the ways I earn my living.

But I also speak to you as a member of the National Academy of Sciences (NAS), to which I was elected in 1972, as one who has been active in its affairs. I have had the opportunity to work both at the Academy and at its operating arm, the National Research Council (NRC), that produces most of the Academy's reports. In the Academy itself, I am currently chairman of the more than 180 elected members (out of a total of about 1450) who are behavioral and social scientists -- anthropologists, economists, psychologists, sociologists, political scientists, and related disciplines. Before that, I chaired the section of Psychology. In the National Research Council, I served from 1973 until 1979 as a member and then as chair of what is now called the Commission on Behavioral and Social Sciences and Education (CBASSE), one of the four explicitly disciplinary branches of the NRC. Since 1982 I have been a member of the Report Review Committee, which is composed of members of NAS, the National

Academy of Engineering (NAE), and the Institute of Medicine (IOM). This committee supervises the review of every report emanating from CBASSE and every other branch of the NRC. Its role is quality control, and it is advisory to the Chairman of the NRC who ultimately decides whether or not a report satisfies NRC standards. Since 1984, I have been co-chairman of the Committee on Basic Research in the Behavioral and Social Sciences, one of the forty report-writing units under the supervision of CBASSE. That committee is now completing a ten-year outlook study for the National Science Foundation and other public and private agencies. With my co-chair, Professor Neil Smelser of the University of California at Berkeley, I gave testimony to this Task Force last September, based largely on that project.

Let me add that, like the some 8000 scientists who participate annually in these activities in the Academy complex, I do not make even a fraction of my living from them. Each of us performs them on a voluntary, part-time, wholly unpaid basis. The reasons why we devote so much time to these organizations and what I have learned about them in the last decade and a half are what my testimony today is about.

I wish to cover four main points. First, I will briefly outline what I consider to be some of the unique features of the Academy complex for providing advice to government. Next, I will briefly review the history behind the relatively recent emergence of the behavioral and social sciences as important components of the Academy complex -- in membership in the Academy, in the increasing role of CBASSE in the NRC, and of these sciences in committees of other branches of the NRC. Third, I will cite several recent CBASSE reports which typify the kinds of work presently underway. And finally, I will discuss my sense of future opportunities for government to draw on the behavioral and social sciences.

UNIQUE ROLE OF THE ACADEMY COMPLEX

The two Academies and the IOM are, as you know, a highly select group of scientists who, in the eyes of experts in their own field, have made major contributions to their sciences. Among scientists, election to these groups is, aside from a few very prestigious awards, the highest honor achievable. Because the Academies have stature and take very seriously the responsibility embodied in their Charter, they have been able to make the NRC work as it does. To my knowledge, there simply is no other organization that has the following features:

* It is able to call upon in a highly organized and systematic way the entire U.S. scientific community to provide its knowledge and advice on a voluntary basis.

* It commands world-wide prestige and, in a country that has no centralized scientific establishment, it provides a natural voice for dealing with the scientific establishments of other nations.

* It endeavors to build consensus about science related policy issues, while at the same time allowing for dissent when complete consensus proves impossible.

* It arranges, on a daily basis, for people from all relevant disciplines -- physical, biological, engineering, social, and behavioral sciences --to work together on tasks having major scientific and engineering components. The ability to identify the best experts in the country rests upon having in place a well-run, standing structure that knows how to take into account the multiple disciplines and points of view needed to construct committees that are seen by reasonable people as both expert and balanced.

*It takes on primarily those controversial problems that do not admit simple technical answers, but rather those that lie at the complex interface of several disciplines and which require the marshalling of existing scientific evidence and the assessment of its implications for public policy conclusions. It typically shuns those problems that are better carried out by a data collecting organization or by a professional consulting firm.

* It has a uniquely defined role relative to government while, at the same time, it maintains the prestige, independence, and objectivity that permit it generally to resist pressures from either private or government sources. This leads it to have an unusual degree of credibility with the public, with government, and with the scientific community.

* It is responsive to the nation. As the late Philip Handler, then president of the NAS, wrote "...it is the changing agenda of the American People that shapes the agenda of the National Research Council."

* It is deeply concerned with quality control over its reports, and it maintains sufficient collegial respect in the science and technology community to carry out very serious reviews which often lead to considerable restructuring of reports.

In short: if this structure did not now exist, some one would have to invent it.

THE BEHAVIORAL AND SOCIAL SCIENCES IN THE NAS OVER TIME

Shortly after the NAS was chartered by Congress in 1863, the section on anthropology was established and in 1911 psychology was added. The first psychologist to be elected was James Cattell in 1901, followed two years later by one of the most literate and famous psychologists, William James. During World War I it was recognized that the relatively few members of the, by then, highly honorific NAS simply could not, by themselves, provide all of the advice requested by the government. This led to the creation of the NRC which, while under the close supervision of the NAS, could draw on the expertise of the entire scientific community. At that time, behavioral scientists played a limited role, although they were involved in the selection procedures used by the armed forces. By World War II the role of psychologists and anthropologists had greatly increased, and the NRC established standing committees on vision and hearing. During the 1960s, after prolonged debate, a major decision was reached to incorporate the other branches of the social sciences into Academy membership. New sections in economics and in the social and political sciences were created and in the first five years a special effort was undertaken to elect to the NAS the nation's most distinguished behavioral and social scientists. As I said earlier, over 180 such scientists are now members of the NAS.

THE BEHAVIORAL AND SOCIAL SCIENCES IN THE NRC TODAY

In 1973, the NRC was reorganized, creating four major disciplinary divisions, one concerned solely with the behavioral and social sciences. Program expenditures by the forerunner of CBASSE were about $1 million by 1975 and are expected to exceed $6 million in FY 1987, which is about 15 percent of the total spent on studies in the NRC. This figure does not take into account the fact that many of the committees in other parts of the NRC include behavioral and social scientists, a point to which I will return in a moment.

Behavioral and social science contributions to the work of the NRC fall into two distinct categories: (1) studies housed in CBASSE on major social or behavioral issues that are addressed principally by those disciplines; and (2) providing research expertise to studies being carried out in other parts of the NRC but which draw on a behavioral or social science as part of their technical knowledge base. Let me, briefly, give you some examples of each type of activity, beginning with several recent reports on major social issues.

In early March of this year, CBASSE's Committee on Population released a major report on the relationship between population growth and economic development. Prepared at the request of the U.S. Agency for International Development (AID), with additional support from the Rockefeller and Hewlett Foundations, this report addresses an issue that has become central to the debate about U.S. assistance for family planning and other population-related programs in the development world, namely: Does rapid population growth have a positive or negative impact on economic development? In the late 1960s and early 1970s the answer to that question was taken for granted -- reducing the rate of population increase in developing countries was considered essential for economic and social development in the Third World. In recent years, that assumption, along with U.S. programs aimed at reducing population growth rates around the world, has been strongly challenged.

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On a topic related to population matters, you may remember last summer's report on immigration statistics, subtitled, "a story of neglect." A panel of CBASSE's Committee on National Statistics was commissioned by the Immigration and Naturalization Service to examine the adequacy of the nation's system for collecting and maintaining data on immigrants to this country. It concluded, after an exhaustive two-year study, both in the field and in the files, that the current system is woefully inadequate and, more startling, that almost no one seemed to care! The panel's recommendations for correcting this situation were aimed not only at the INS, but at a number of other Executive Branch agencies and the Congress, as well.

Academy social scientists also have been involved for several years in attempting to develop and evaluate new approaches for dealing with the wide range of problems that result from the excessive use of alcohol -- from drunk driving to teenage depression and family breakup. A 1981 CBASSE study, conducted at the request of the National Institute on Alcohol Abuse and Alcoholism, has had an important impact on the professional, voluntary, and governmental organizations concerned with preventing these problems. To meet the demand for a more accessible account of this and two other Academy reports, a new book was written for a popular audience, on the Academy's own initiative, that brings together under one cover the scientific evidence and recommendations for public policy. Alcohol in America: Taking Action to Prevent Abuse has a forward by Secretary of Transportation, Elizabeth Dole, and concludes, among other things, that much can be done to make the world a safer place for those who drink and to protect those who don't from those who do. Its aim is to focus attention on ways to prevent alcohol-related problems before they occur and on the relatively large number of people who would not be classified as alcoholics, but whose drinking may cause problems for themselves or others from time to time. One of the crucial features of this report is that many, if not most, of its lessons are directed to the state and local level and to private citizens and businesses.

A different kind of report, representing the indispensable nuts-and-bolts role that the NRC plays as advisor to technical government agencies, is The Bicentennial Census: New Directions for Methodology in 1990. In preparing for the twentieth national population count, the Census Bureau has a limited amount of time and very limited budget to test and evaluate new methods and new technologies that might make the census less expensive, more accurate, and more effective in its many uses. These, you recall, include apportioning and districting seats in the House of Representatives and state legislatures, allocating $80 billion in federal formula grants, planning local services, public works, commercial and industrial siting decisions, and corporate marketing strategies.

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A fourth recent major study, carried out by the Committee on Child Development Research and Public Policy, examined available scientific evidence relevant to a question that has become increasingly important for virtually every one of us, directly or indirectly. The question is: What is the effect on children of having a mother who works? This study, sponsored by the National Institute of Education, concludes that there is no evidence that a "mother's employment, per se, has consistent direct effects, either positive or negative, on children's development and educational outcomes" and that a variety of other intervening factors seem to be more important in shaping children's development than parents' work itself, including attitudes, values, and behavior of the parent toward work and parenting. This committee is continuing its examination of these and a variety of related issues such as the effect of day care on very young children and the problem of family violence.

As a final example, in response to a request from the National Institute for Occupational Safety and Health, the Committee on Vision undertook a critical review of the scientific evidence regarding the impact of occupational video viewing (i.e., working at a personal computer screen) on the vision of workers. Its report, released in 1983, has become the classic reference in this field and one of the most widely cited reports ever produced by the Academy. The panel concluded that there is simply no evidence to support the frequently heard claims that working at video display terminals causes physical damage to the eye (e.g., cataracts) or any other major physical problem (e.g., miscarriages). The report does note that oft reported complaints of fatigue, stress, headaches, and so forth are probably the result of a combination of characteristics of the job itself and/or ergonomic considerations in the arrangement of the equipment ~~the~~ and furniture (and therefore easily correctable).

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Finally, with regard to the work of behavioral and social scientists within the Academy and the National Research Council, let me note that many studies conducted by other divisions of the NRC both benefit from and in some instances, require the expertise of social and behavioral scientists. A good recent example is the Congressionally mandated study of the 55 mph speed limit, conducted by a special committee formed within the NRC's Transportation Research Board. It was clear from the outset of this work that many of the issues the study committee would have to address were social or behavioral in character --from cost-benefit analyses of the tradeoffs between time and money saved on the one hand and lives that might be lost, on the other, to understanding of the factors that cause drivers to comply or not comply with posted speed limits. Similarly, behavioral and social scientists have been involved regularly in the very large number of studies carried out by the NRC on environmental issues and requiring cost-risk-benefit analyses. It has often been left to the social scientists, for example, to tackle the most difficult component of such tradeoffs: namely, the measurement of benefits, which, like clean air, or quiet, or acid-free lakes, are highly subjective. (We know it costs roughly $1 million to retrofit a 727 to make it significantly quieter on takeoff, but how much is a quieter environment worth?) Even more important than their contributions to specific studies, the presence of behavioral and social scientists in the Academy and the NRC ensures that questions about the social impact of technologies will always be asked (if not always answered to everyone's satisfaction).

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CONCLUDING REMARKS

All of us are acutely aware of the enormous changes, both technological and social, that are taking place rapidly throughout the world. It is manifest that these changes have unprecedented impacts on individuals, on various groups of people, on nations, and on the relations among nations. To be sure, some of these impacts are largely technical in origin and the resulting problems have technical fixes, but such cases are really very rare. The vast majority of the changes and resulting problems are a blend of technological and human aspects, and to ignore the latter is fraught with terrible dangers. The reactions of people to technical matters are often at least as important as the technical aspects themselves -- witness Challenger, Chernobyl, acid rain, earthquake predictions, to name only a few recent and prominent ones.

Often the government appears to think otherwise, to act as if it is sufficient to fund physical and biological scientists and to ask only them for advice. That, I would urge, is a mistake, one that almost two decades ago was recognized by the NAS when it added materially to the behavioral and social science strength of the NRC. I urge the Congress to take advantage of such scientific resources, both in the NAS/NRC and elsewhere, not with the idea of finding quick fixes to complex social problems but with the idea of getting as sophisticated, dispassionate advice as possible about what we already know and how we can learn more that is relevant to the problem. Gradually, that knowledge will affect what we do, as it has in some of the examples I have mentioned.

Thank you for your attention. I will be happy to try to respond to any comments or questions you may have.

DISCUSSION

Mr. **Fuqua**. Thank you, Dr. Luce. The academies have taken steps to establish an independent fund based on unrestricted industrial contribution, and of course this fund allows them to initiate their own studies. Will these self-initiated studies benefit the United States in science and technology, or will they somewhat distract from the Government's request for studies—more specific studies, as you have outlined in the course of your testimony?

Dr. **Luce**. In my view they will be beneficial. I think that the reason that one wants to have this freedom for the Academy to initiate certain classes of studies is that certain socially-important problems tend to fall through the cracks of any structure. You have an existing structure and various agencies have their particular concerns, and sometimes problems don't fit very well in the structure, and yet they are very important problems. The Academy, I think, is one place that can identify such problems and, if it has independent resources, it can bring forward to the national attention the nature of the problems and potential policy options that are available. So I think it in fact would not prove distracting. It would be very useful.

Mr. **Fuqua**. You recently completed—the national academy and the National Research Council—a study requested by the NSF to develop the priorities over the next 10 years for funding increases in behavioral and social sciences. Is that the type of proper study you think that the academy should be doing for Federal agencies?

Dr. **Luce**. Let me correct one part of your statement. You said that study is completed. I wish it were, but we are still in the process of drafting the final report, and it has yet to be reviewed. We are close to being completed.

I think it is indeed the kind of study that I cannot imagine what other organization would be able to take it on. It requires a——

Mr. **Fuqua**. Because of the broad nature of it?

Dr. **Luce**. It is so broad, and it requires the coordination of so many disciplines, and how you would pull them together under other auspices is not clear to me. I suppose it could be run through a university as some sort of a special ad hoc thing, but that I think, would not be nearly as satisfactory or probably as well respected as these have tended to be, and I hope ours will be.

Mr. **Fuqua**. Well, how effective do you think that the advice of the academies would be utilized by the Federal agencies, particularly in the area of behavioral and social sciences?

Dr. **Luce**. Well, I think that various examples that I have mentioned indicate that it is being paid attention to. I think, for instance, our report will probably be examined rather carefully by NSF, and I hope that some of the other Government agencies will also attend to it, and that it will probably cause them to reevaluate certain of the relationships they have with the scientific community and the way they are structuring certain things in the present NSF structure.

I know that the NSF director and the head of the Directorate of Biological, Behavioral and Social Sciences are very interested in what we are proposing, so I am sure it will be read and hopefully will have an influence.

Mr. **Fuqua**. Do you see this as the type of thing that will increase the utilization of the academies to provide similar advice for the future?

Dr. **Luce**. I would hope that as our track record is established that we are able to provide helpful advice, that, yes, we will be drawn upon. I am certainly urging that that be carefully considered.

Mr. **Fuqua**. How about in broad areas that affect national security such as terrorism? I'm not really speaking of necessarily dealing with it, but more of understanding how it happens?

Dr. **Luce**. I think we can be helpful in trying to study it. We do not at the moment, to my knowledge, have a committee that has been examining it.

Mr. **Fuqua**. I am not aware either.

Dr. **Luce**. I am hesitating a little bit because the problems of dealing with something of that character in a way that will produce any noticeable change in the short term, I wouldn't want to make promises. I think it would be worthwhile trying to see what could be brought to bear on it from the general behavioral science community, including psychiatry and the basic sciences. Whether in fact it would make any substantial difference is hard to say.

I think that one thing that may be helpful is to get a better understanding about the nature of some of the ideologies that lie behind the terrorism and some of the cultural differences. I think there is a terrible difficulty if we try to project onto these other nations, and other groups, our own set of values and assumptions without really thinking through quite carefully how they see the world. Then it is very easy to be misled in the policies that one starts to follow, and I think it is at that level that we probably could be helpful.

Mr. **Fuqua**. Would not a lot of the evaluation or particular research in behavioral and social sciences be on the long-term basis, though?

Dr. **Luce**. I think it has to be.

Mr. **Fuqua**. It is not something that just happens in the short term—the first year or 2 or 3 years or 4 years?

Dr. **Luce**. It definitely has to be long-term.*

Mr. **Fuqua**. Do you see any other means of providing the Federal Government with scientific and technical advice in the behavioral and social sciences?

Dr. **Luce**. Well, I think that the one thing that I would be particularly concerned about, and I tried to make clear in my testimony, is that there are many problems that get cast as purely technical—physical science or biological science—that have a heavy behavioral component, and there has been a tendency in the past not to have it adequately represented on a lot of committees. That, I think, has changed a great deal. The NRC, itself, is very much more aware than it was 15 years ago of its need to have participation from the behavioral sciences, and they are regularly represented on the governing board and do participate to some degree, but there is still a tendency to think that it is unnecessary on the part of some people. We are just simply going to have to try and change that image.

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*The May 1986 issie of the American Psychological Association's Monitor includes a discussion of psychological perspectives on terrorism. Following the testimony, I checked with CBASSE to see if they have underway a project on terrorism. I was told that it had been raised internally as a possibility, but that they felt it could only be seriously addressed as an, at least partially, classified study in which access would be available to classified intelligence information about terrorism.

Mr. FUQUA. The academy has in the past and will continue to provide advice on a number of topics such as statistical trends and methodologies for problems of national concern, psychological science, urban policy, substance abuse and other types of things. Are there topics of concern to the social scientists that are not being addressed by the academies and should be?

Dr. LUCE. I draw a blank. I am sure there are any number of topics that individual social scientists would want to answer. At the moment, I think that the coverage that is being handled by an organization like CBASSE, which has representatives from all of the disciplines, tends to be pretty good. Now, it is true that there are specific things that, from to time, feels that it cannot induce the Government to support, and it then has several times resorted to getting private funds in order to do a study which is aimed at the Nation. It is something that, in principle, the Government should have supported, but simply, as I said before, it tends to fall through the cracks.

One example at the moment is the study of black America that is going on, a very large study, and that we found it impossible to get funded by any Federal agency, and so it was funded by private moneys. There will be things of that sort.

Mr. FUQUA. How about areas such as productivity of workers?

Dr. LUCE. That has, I think, been under study.

Mr. FUQUA. Under study?

Dr. LUCE. It has been studied. I'm sorry.*

Mr. FUQUA. Yes.

Dr. LUCE. That was supported, as a matter of fact. That will be, again, a long-term ongoing thing. I think there is all sorts of concern about our productivity, vis-a-vis, particularly, the Japanese and the various Far Eastern countries, and that is going to be an ongoing issue, how to change those productivity figures, and I am sure we are going to continue to have additional studies along those lines.

Mr. FUQUA. Dr. Luce, thank you very much for joining us this morning. We appreciate very much your contributions.

The hearing will be adjourned.

[Whereupon, at 11:50 a.m., the task force was adjourned to reconvene on Wednesday, May 7, 1986, at 10 a.m.]

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*The relevant CBASSE report is "Measurement and Productivity." In addition, the NRC's Manufacturing Studies Board has issued a series of reports on the competitiveness of various American manufacturing sectors.

THE ROLE OF THE NATIONAL ACADEMIES

WEDNESDAY, MAY 7, 1986

House of Representatives,
Committee on Science and Technology,
Task Force on Science Policy,
Washington, DC.

The task force met, pursuant to call, at 10 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the task force) presiding.

Mr. Fuqua. Today we continue our 3-day series of hearings by the Science Policy Task Force on the subject of the future role of the national academies.

Our first witness today is Mr. John Coleman, who is the former executive officer for the National Academy of Sciences and the National Research Council and he will provide us with some insight as to past operations of these activities and offer some suggestions for the future.

The second witness will be Dr. Peter Raven, the director of the Missouri Botanical Gardens, a member of the National Academy of Sciences executive committee and the governing board of the National Research Council. Dr. Raven will address some of the overall academies' operations and impact on U.S. science.

Mr. Coleman, we are pleased to have you this morning and await your testimony.

[A biographical sketch of Mr. Coleman follows:]

John S. Coleman

Born: Jan. 15, 1914—Honolulu, Hawaii.

Education: B.S., College of William & Mary, 1932-1935 Physics, Mathematics. S.M., Mass. Inst. of Technology, 1938-1940 Applied Physics.

Employment: 1935-36 D.C. Dept. of Highways—Surveyor. 1936-38 W.C. & A.N. Miller Co.—Const. Supt. 1938–40 MIT Spectroscopy Lab.—Supervisor. 1940–43 NDRC-OSRD Section D-3, Div. 16, Instruments—Technical Aide. 1943–44 Harvard Underwater Sound Lab. Research Assoc. Head, Sonar Div. 1944–45 OSRD London Office, AntiSubmarine and Submarine Warfare. 1945–46 OSRD-Columbia Univ. OSRD Summary Tech. Reports Group, Editor and Deputy Director. 1946–53 NAS-NRC Comm. on Undersea Warfare, Exec. Secretary. 1953–65 NAS-NRC Div. of Physical Sciences, Exec. Secretary. 1965–79 NAS, Executive Officer of NAS and NRC. 1979–80 NAS, Staff Consultant. 1980–81 NRC Naval Studies Board, Member. 1980–83 NRC Steering Comm. for Second Five-Year Outlook for Science & Technology, Vice-Chairman. 1980–83 Amer. Inst. of Physics, Policy Planning Comm., Member.

Retired as staff member, NAS, Jan. 31, 1980.

STATEMENT OF JOHN S. COLEMAN, ARLINGTON, VA, FORMER EXECUTIVE OFFICER FOR THE NATIONAL ACADEMY OF SCIENCES AND NATIONAL RESEARCH COUNCIL, WASHINGTON, DC

Mr. COLEMAN. I have prepared a summary of the statement that I submitted to the committee staff, which I believe you have.

Mr. FUQUA. Yes, we do and we will make that part of the record.

Mr. COLEMAN. And with your permission, I will read from this because it is fairly short and I expect to have some questions.

My name is John Coleman. I am now retired from the National Academy of Sciences where I was employed for about 34 years. My last full-time position there was as executive officer of the NAS and the NRC, in which capacity I served from July 1965 until May 1979.

I have submitted a prepared statement, responding to the best of my ability to the 12 questions raised by the committee. I also qualified my response by noting that since my retirement I have had little contact with the academies and my responses, therefore, must be limited to the period with which I am familiar.

In summary, I believe the academy has generally responded well and usefully to the wide variety of requests it has received from the Government.

World War II brought science and Government together, largely through the agencies of the old NRC-OSRD. Following the war, Detlev Bronk, as Chairman of the National Research Council and later, as three-term president of the academy, sought to continue and extend this cooperation to civil as well as defense sectors of Government. Under his leadership and that of his successors, Frederick Seitz and Philip Handler, the size and scope of these relationships expanded. I might add parenthetically that early in his tour as president of the academy, Mr. Bronk wrote to all of the members and asked for their views on whether the academy should extend its role as advisor and had an overwhelming positive response.

At the time of my retirement, there were some 800 committees with about 10,000 members. In addition to the service provided to the Government, these 10,000 scientists, engineers and medical research people acquired experience and understanding of the problems and the processes of Government. It was a two-way street and continues to be a two-way street, benefiting both the Government and the scientific community.

The academy and NRC, in my opinion, generally performed well when the questions addressed were strongly rooted in technology and science. It had greater difficulty with those which were primarily social or political in nature. Responses were more efficient if they could be handled by an informed existing committee and staff, adept in identifying significant questions.

Improvement in NAS performance, I believe, lies in this direction—having informed and knowledgeable committees, and staff and mechanisms for identifying and enlisting the efforts of such individuals if needed with minimum delay, including the coopting of personnel from universities, industry and Government to supplement the staff of the academy.

The unique value of the academy is, and must be, its ability to identify and call upon the best the Nation affords in knowledge from the frontiers of science and technology and mature judgment to be used in behalf of our Government and the communities of science itself. For this reason, I believe it important the academies speak with one voice when questions raised transcend the constituent interests of each academy. Thus, I believe the question of separate charters might well be divisive.

The breadth of interest and independence stemming from self-government distinguish the academy from other competent and well-qualified advisory groups. These characteristics, together with a tradition of excellence, should be preserved and where possible strengthened, extending from the quality of its selected members, to the appointments of committee members and staff, to the preparation and review of its reports, even while recognizing some burden in the time required and the cost of providing this assurance.

Finally, the question of the academies effectiveness was raised. There are, I am sure, examples of both kind, good reports and reports that had little impact.

The NAS charter calls for the academy to respond "whenever called upon"—advice that is sought is generally better received than that which has not been solicited, especially if there is no single or appropriate agency to respond to such advice. Gratuitous advice on organization and management often finds resistance. Scientific and technical facts are not always the major base for decision or lack of decision. In this same vein, the willingness of the individual to accept—by individual I mean the committee member or chairman—to accept what are often difficult time-consuming assignments is enhanced by recognition back from the agency in the form of some response, positive or negative, to the committee's report.

In the foregoing, I have, within my stated limits, implied ways in which the overall performance and usefulness of the academies might be improved. I am sure that the present administration of the academies has considered and taken steps in these directions.

I do believe the academy complex can be of even greater service to the Government, Congress, and the executive branch, in the years ahead and that quality of response and response time will become increasingly critical. There are various ideas and suggestions, both old and new, perhaps not appropriate for consideration in these hearings. Should the occasion arise, however, I am sure that those of us who serve the academy will respond if called upon.

[The prepared statement of Mr. Coleman follows:]

Testimony of

John S. Coleman

Retired Executive Officer
National Academy of Sciences and
National Research Council
Washington, D.C.

Before the House Committee on Science, Research and Technology

FUTURE OF THE NATIONAL ACADEMIES

May 1986

My name is John S. Coleman. I reside at 3010 N. Florida St. in Arlington, Virginia. I am now retired from the National Academy of Sciences where I was employed from November, 1946 until January, 1980. I served as Executive Officer of the NAS and the National Research Council from July, 1965 until May, 1979. A complete resume has been submitted with this statement.

I am pleased to respond to the request of Chairman Fuqua to testify at this hearing of the Committee on Science and Technology on the subject, "Role of the National Academies as a component of its review of American Science Policy," and in particular, to reply to the twelve questions appended to that request. Before doing so, however, the Committee will appreciate the fact that seven years have elapsed since I retired from the post of Executive Officer and almost six years since my association with the preparation of the NRC "Five Year Outlook" report. I have had little if any association with the Academy since that time. As a consequence, my response to events. operations and performance must be limited to the period mentioned above.

The statement which follows consists of my response to the questions of the Committee in the order of their presentation together with certain additional comments which I hope may be of some use in the Committee's deliberations.

1. How have the academies fulfilled the original mandate of the Science Academy's Congressional Charter to "whenever called upon by any department of the government investigate, examine, experiment, and report upon any subject of science or art..."

I believe the NAS has fulfilled its mandate credibly and in many cases exceedingly well. Following World War II and especially under the leadership of its President, Detlev Bronk (1950-1962) the Academy welcomed and even sought opportunities to assist agencies of the government in identifying, meeting and helping to solve both scientific and technologic problems and issues of a wide variety including communication and cooperation in international science.

The phrase, "whenever called upon..." was given key significance in two respects. First, that there was an obligation to respond to any such request but only if it fell within the competence and professional qualifications of the Academy and the NRC to undertake it and was of a nature and significance to deserve the careful attention of experts expected to serve without compensation. Second, it provided some assurance (if not guarantee) that the agency, in seeking advice and assistance, was prepared to accept and respond to the Academy's effort. Whenever appropriate, the NAS-NRC report to the agency was also available to the public.

It should be noted that these boards, committees and panels not only provided an opportunity for public service for the thousands of individuals who were called upon, but diffused a greater understanding of the problems and efforts of the government agencies to anticipate and deal effectively with them.

2. In what manner and how effectively does the advice provided by the academies meet the needs of government agencies asking for it, and can that advisory process be improved upon? Will the process of utilization change in future decades as the character of American science evolves and the needs of the government change, and if so, how?

To be of maximum usefulness and effectiveness, communication and cooperation are essential. Both the Academy and the agency must understand and agree on the question(s) to be considered, separating, so far as is possible, the scientific from the socio-political aspects of the question. Can it be built and will it work are contextually different questions than should it be done.

In those cases where the Academy had in place a standing advisory body with experienced staff generally well acquainted with the agency and its program, such as the Space Science Board, the Naval Studies Board, and the Food and Nutrition Board, effectiveness is enhanced. In those cases where new groups and relationships must be established, the process is less efficient, especially if the problem has high societal content and the scientific-engineering aspects are perhaps not central. An example might be the difference in the SST and Shuttle Main Engine studies.

I believe the present process is fundamentally sound but can be improved in many ways that will be addressed in my response to succeeding questions.

3. On science and technology issues which overlap NAS/NAE/IOM, to what degree should the Academy attempt to speak with one voice?

Except on matters relating to their membership and constituents, I believe they should attempt to speak with one voice when advising government. This does not exclude minority opinions or specific dissents.

Prior to the formation of the NAE and the IOM, the NAS-NRC dealt extensively with both engineering and medical questions. Indeed, the principal role of the NRC in World War II was in the area of medical research. Further a principal virtue of the NAS as an advisory body is the breadth of its scientific and technologic interests and its ability to bring together composite groups representing a variety of disciplinary experience and perspectives tailored to the need. In this respect, I believe the Academy is unique among national institutions and should take full advantage of this breadth.

4. In the decades ahead should the mix of advisory bodies now being called upon by the government, in which the academies play a prominent but not exclusive role, be adjusted in the light of present experience and/or future needs?

Would that I could read the future. In contrast to such bodies as the Rand and Aerospace corporations, the OTA and others within or organized and supported on a continuing basis by one or another agency of the government, the Academy generally requires more "start-up" time, unless the question is fully appropriate for a continuing board or committee or is of such importance and urgency as to be handled on a special basis by direct presidential action.

As the clock seems to run faster each decade, the need for rapid response may well increase. This may encourage the growth of in-house groups perhaps at the expense of breadth of competence and diversity of experience. I believe there are steps which could improve the NAS ability to respond more rapidly and enhance its ability to respond effectively to needs expressed by the government without compromise with the independence and integrity of the Academy as an institution.

5. Is the Congressional Charter for the Science Academy, in its present form, fully adequate to meet the needs of the academies and the government in the coming decades? Should the academies, other than the Science Academy, be defined and recognized by the government and the Congress by incorporation into the present charter or through separate charters, or is the present arrangement with respect to charters satisfactory?

The 1863 charter of the Academy is a remarkably simple straightforward instrument which, to the best of my knowledge remains workable and non-restrictive. I doubt that these qualities would be enhanced if the charter were revised. Although much of engineering and medicine is rooted is science, the professions of engineering and medical practice differ in major respects from that of science. The name of the institution is perhaps of less importance than its nature - discovery of new knowledge and techniques, rather than professional practice.

6. Is the project-study approach, which now predominates in defining, funding, performing, and reporting academy studies, the optimum approach, or are there other mechanisms which for some purposes are better suited to the capabilities of the academies and the needs of the government?

The very large span of capabilities represented in the present NAS/NAE/IOM/NRC makes it infeasible and expensive to have in place and informed bodies ready to come promptly to grips with any request from any agency of government. On the other hand, urgent and major tasks, as noted earlier, can be expedited so that the response becomes comparable to that of an in-place or in-house group. An example might be the comprehensive

Air Force Systems Command study of 1957-58 under T. Von Karman which was organized and completed without benefit of any prior experience with the USAF R&D program.

This implies that the staff and procedures available to bring to bear on such programs might be strengthened and utilized more widely.

7. Should the government take any steps over the longer term to strengthen and augment the ability of the academies to initiate their own studies on topics for which requests have not been made by agencies of the government, including steps that would make such studies financially feasible?

Feelings are mixed on this question. Many members in the past have resisted the concept of a government endowment or line item funding, believing that the Academy's independence would be jeopardized.

I believe, however, that there are useful steps that could be taken - expanding the concept of standing committees and boards which initiate, with agencies concurrence, projects and programs which have been both useful and pertinent. Examples are broad contracts written with the Surgeons General and the Naval Studies Board and predecessor committees. COSEPUP could and to some extent does provide such a possibility.

In past years, President Bronk often said if a problem is important and well-conceived he had no doubt that he would find an appropriate agency which would ask the Academy to take it on. He was generally right.

Some years ago, it was proposed that the Academy set up a senior body, separate from the normal operations of the NAS, which, with the aid of a relatively small staff, would prepare for approval by the NAS Council (or Councils) a white paper identifying priority questions which should be addressed by the Academy and the government. This idea might be expanded upon.

8. To what extent does, or should, the Academy incorporate policy concerns into their scientific and technical recommendations and reports, i.e., should policy influence Academy recommendations or should the recommendations be guidelines for policy makers?

If the report has policy implications, it should be the responsibility of the agency and the Academy to be aware of these and in the report proper and/or in the forwarding letter address these considerations - pro and con. A technical committee is not always constituted to deal with broad policy issues and should not be asked to adjust its findings to conform. Nevertheless, in accepting a task from an agency, the Academy should explore and be aware of any policy implications. Good communication by competent staff is essential.

Self-initiated reports are generally policy-related and should also be policy sensitive if they are to be seriously considered and accepted. COSEPUP and the Report Review Committee have substantial responsibility for insuring this awareness, as do the governing bodies of the Academy's components.

9. How well do the academies' policy committees, such as the Committee on Science, Engineering and Public Policy (COSEPUP), the Government University-Industry Research Roundtable, and the Board on Health Science Policy function in providing balanced, relevant, and timely advice?

As I am not familiar with the tasks or performance of the current committees, I have no basis for judgment or opinion on this question.

10. What have been the effects of the series of disciplinary studies covering individual fields of science such as physics, chemistry, and as physics, chemistry, and astronomy, and should they be continued? If so, how can they be improved so as to be of maximum benefit to their intended audience?

Since the early days of COSPUP, (now COSEPUP) the disciplinary studies may well have been the most important single continuing activity of the committee. I believe they have been enormously useful to the major science funding agencies such as NSF, NIH, etc. but also by increasing consensus on priorities and balance in the planning, support and conduct of research to the communities of science reflected in the individual studies . Thus they have been of interest and significant service to universities, faculties and students as well.

In carrying out these surveys, the Committee has sought the active participation of large numbers of those scientists at the forefront of research as well as the input and cooperation of funding agencies and the relative professional and scientific societies. The reports issued have also been helpful in planning for international cooperation in science.

While I believe the NAS-NRC is better able to conduct these studies than the individual scientific societies, the latter should be consulted and involved from early planning to final publication as indeed should the funding agencies which can and do provide substantial input. Although perfect consensus may not be achieved, these efforts help to insure the most efficient use of the resources available to scientific productivity and progress. Special attention might be given to the preparation of a special summary report for members of the directly concerned Congressional committees and agency heads.

11. Are there additional functions in the national interest related to science and technology which the academies may wish to carry out and the government would find desirable and support?

The earlier questions have not been specifically directed to several important areas of academies' concern, including international science and technology and education, particularly at the graduate and post-doctoral level.

In promoting international cooperation in science, the Academy has had a unique and important role in an area of direct and growing importance to the national interest. Through its relationship to the family of international scientific unions, the planning and conduct of world-wide programs such as the IGY and oceanographic survey as well as bilateral exchange programs and international symposia, the base of scientific facilities and knowledge is broadened to the benefit of our own national effort. The cost of modern instruments and facilities will continue to rise as will the critical data they will provide. The role of the academies in planning and helping to manage U.S. participation in such programs should be given strong recognition.

From the time of the early NRC postdoctoral fellows to the present, the NAS has long had an interest in graduate education. Because of its national position, with ties to the academic community government and industry as well as to foreign sister academies, the Academy is in a position to serve as a forum and a catalyst on many issues in graduate education in science and engineering, such as those referred to in Section III of the Committee's Agenda Report. That the NAS now includes the NAE and the IOM suggests a useful role for the academies in this area, both in national and international contexts.

12. What is the perception of the academies and their role vis-a-vis the citizens of the country and to what extent should that factor play a role in the government's use and support of the academies?

The average citizen is not familiar with or even aware of the academies and its purpose or objectives. I believe that it is narrowly perceived as an honorific organization but not clearly distinguished from a multitude of "National Academies of the ..." However, within the research communities of science, engineering and medicine, it is recognized and that election as a member or appointment to one or another of its committees is an honor. It is this latter recognition that is important, for it implies a level of confidence and trust which is uncommon and must be cherished. The NAS must stand for excellence in its election of members, its appointments to advisory boards and committees, its avoidance of bias and special interests (except in the furtherance of excellence in science), and political or regional partisanship. Such an institution, particularly one that was established to serve the nation through its government, can be a resource of enormous value to the government if it is used wisely and its independence and tradition is preserved.

If the academies were perceived as solely honorific in nature or as a component or creature of government, their usefulness would rapidly diminish. The present charter has served the NAS and the government as well.

It is in the government's interest to enhance the perception of the academies by the scientific and technical community by strengthening its ability to respond more effectively to major requests for facts and advice by improving communications with the Congress and Executive branches - perhaps in the support of continuing bodies for this purpose - and by its re-affirmation of the academies as a unique resource serving the national interest.

DISCUSSION

Mr. **Fuqua**. Thank you, sir.

I was looking at your statement and I was trying to follow you at the same time about the separate charter for the various groups that make up the National Research Council and if I heard correctly, you said you thought it was better served as it was structured now, I believe?

Mr. **Coleman**. That is correct.

Mr. **Fuqua**. Are there any recommendations after the many years of experience that you served there under different presidents, different conditions and presidents of the academy, I might add, too, recommendations that you would make for the improvement of how the academy meets the needs of the Federal Government?

Mr. **Coleman**. Yes, with the qualification that I am not familiar with what the current administration of the academy has done, and I believe they have taken steps in some of the directions I would indicate.

I think the time of response is critical, and that depends very largely on adequate and early communication between the requesting agency, or the Congress, or the executive branch, and senior NAS staff officials, including the president of the academy. A mark of good science is asking the right question. In these early negotiations, I have found that the original question which may be raised with the academy perhaps is not the right question. There is always a certain amount of discussion about what should the committee really address in its deliberations. You need that in order to form the right committee.

The second thing I think could be improved is a wider utilization, and I hope the academy has moved in this direction, of the resources available to identify the best people to be called upon. The academy, members themselves are a primary source of such guidance, as are the various chairmen and members of the NRC committees and the staff. But we have had some difficulty in identifing the brightest younger people, and there are a lot of them. We set up, when I was executive officer, a special office for this purpose, to review all appointments, which according to the academy's bylaws and constitution, remains the responsibility of the president of the academy. Obviously, that has to be delegated. It is a large job. It is a job that has resources available to it that I am not sure we always called upon as effectively as we might, and I think that need, as well as the early communication with the agencies, the early alert, if you like, are two of the areas I would emphasize in improving the performance of the academy.

Mr. **Fuqua**. How about the dissemination of the information once the academy has made its report known. Do you think there is adequate dissemination of that report, not necessarily to the agency or maybe the Congress, but do you think it is valuable to the general public?

Mr. **Coleman**. I would make a distinction between the agency and the general public. I think we have done an increasingly better job in making the NAS reports available to the public.

As far as making results of NRC studies available to the agency, the most effective programs I remember are those in which the agency people, particularly those who are in the scientific and technology operating positions, participated in the studies themselves. In several cases I can remember the recommendations of the panel or the task force, the committee, or whatever it happened to be, were implemented even before the report was printed because they were aware of it. Now, if there is that kind of intimate exchange and understanding, obviously you can get much better results than if you depend solely upon a published report.

I think in many of the major studies, where there is great public interest, that the report needs to be supplemented perhaps by presentations of one kind or another. To some extent, committee members who have participated in the deliberations will do this in their own professional communities. In a few cases, the Academy has held public meetings to raise questions which were considered in the report and to broaden a forum for a discussion with the public and the Congress.

Mr. FUQUA. Since you left the academy, they have become more involved with industry participation in some of the studies and so forth, and providing science and technology to the Federal Government. Do you think that has improved, and is part of the changing of the times, and can that improve the academy's effectiveness?

Mr. COLEMAN. Well, it is a little hard for me to say because most of that has happened since I left my post. I do remember in the early days when the National Academy of Engineering was first formed as part of the corporation of the Academy of Sciences, there was a good deal of concern about the fact that it could become a spokesman for industry, rather than for individual scientists or engineers who worked for industry. And there were some members of the academy who argued against having a joint operation. On the other hand, I believe it has provided an opportunity to raise issues and problems, and also, knowledge of issues that perhaps weren't as easily available to the Academy of Sciences before.

Mr. FUQUA. Do you think with the involvement of unrestricted industrial contributions?

Mr. COLEMAN. If they are truly unrestricted, I see nothing wrong with that. I should point out——

Mr. FUQUA. I am really talking about the self-initiated studies that the academy may do. Will that distract from the Government's request of various studies that they may do?

Mr. COLEMAN. I would certainly hope not. I would point out that in the pre-NAE days, the National Research Council, which is the operating arm of the academy, used many, many scientists and engineers from industry, and many of the members of the new academy were familiar with the NRC and the academy's operation by virtue of having served on its committees. So in a sense, it was not so much change of faces. There was some question of whether the members and committees were primarily derived from the academic community, or from industry. That was the basis of a lot of discussion. The old academy primarily represented the academic community, and the NAE was regarded as somewhat of a change.

I have not seen during my tour, and I had 15 years of living with it, any strong evidence of industry attempting to use the academy as a spokesman for industry.

Mr. FUQUA. Do you think that these self-initiated studies are good for the academy, maybe areas that they perceive that maybe the Government does not, and that they should be looking at? Should there be efforts on the part of Government to support self-initiated studies that hasn't been done in the past, that hasn't been the policy of the Government in the past?

Mr. COLEMAN. Well, I think that depends entirely upon the specific study, I think you have to look at this on a case-by-case example. I am reminded of some of the NAS self-initiated studies back in the early days of Bronk and Seitz. Dr. Bronk once said, "Don't worry about finding support for this. If it is a good idea, I will find some agency or a foundation that will support it, but first develop the idea and then let's have a look at it," and I think that is the way I would approach any self-initiated study.

Mr. FUQUA. Mr. Coleman, thank you very much for joining us this morning. We appreciate your comments and the perspective and vast knowledge that you have about a very treasured national resource.

Mr. COLEMAN. I hope I was of some help, and thank you for the opportunity.

Mr. FUQUA. Thank you very much.

Our next witness will be Dr. Peter Raven, director of the Missouri Botanical Gardens. Dr. Raven, we are pleased to have you here this morning.

STATEMENT OF DR. PETER H. RAVEN, DIRECTOR, MISSOURI BOTANICAL GARDENS, ST. LOUIS, MO

Dr. RAVEN. Thank you very much. I am very pleased to be able to come here and offer my perspective on this problem. As you mentioned a minute ago, I am a member of the Governing Board as well as a member of the National Research Council and of the Council of the National Academy of Sciences, and the Advisory Committee of the Office of International Affairs. In addition, I am chairman of the National Science Foundation Advisory Committee on Biological, Behavioral, and Social Sciences, and, as I will mention again in a minute, the chairman of a committee on research opportunities in biology that is currently underway with the National Research Council. I also have the usual scientific experience in participating in studies by OTA and other similar bodies.

First I would like to offer a few comments on the NRC operation in general. There is literally no other body in this country which represents and encompasses the full range of scientific and technological expertise in this country, none which really can command the whole array of available people for this subject and none which really has the standing to put them together for the purposes we are considering now.

The committees are very carefully chosen, representing many thousands of people. The scope of each study is very carefully considered. One procedural improvement in the National Research Council Governing Board has been the creation of an executive committee composed primarily of the presidents of the academies which has been able to consider in more detail the exact scope of the studies, the charges for the studies and the suitability for the academies before they are undertaken.

The quality and diversity of the volunteers that serve the National Research Council is unparalleled and I think results in intensive and very competent studies which are reviewed very carefully and objectively. That of course leads to a problem of speed which concerns us all, but it is really literally impossible to review these studies properly and to get the right kind of expertise involved in the reviews, and at the same time turn out the results of the studies as fast as all of us like.

One of the important points I want to make is that our academy and National Research Council complex is the envy of many countries around the world. I myself have served on committees that have advised the Mexican Government and African countries about how they might go about setting up similar operations.

What we are interested in is the fact that the organization is essentially nongovernmental and at the same time is chartered to give advice to the Government.

Now for the substance of what I want to say, I would offer remarks about two areas of special interest to me. One is basic biology. I will give you examples of two studies in basic biology at the academy, and then I want to say a little bit about the role of the academy in international relationship and development and industrial competitiveness on the world scale.

In the area of basic biology, I will mention two examples. The first will be the operations of the Committee on the Use of Laboratory Animals in Biomedical and Behavioral Research. This committee is carrying out one of the self-initiated studies of the National Research Council, although legislation was introduced in Congress at the same time calling on a similar kind of study, so it illustrates very well the ability of the National Research Council to bring together scientists and nonscientists to the central issue. The membership of the committee includes an animal welfare advocate, an ethicist and a lawyer, and it also includes scientists who have, and have not, used laboratory animals regularly. The breadth of membership in the committee is mirrored by the work of the committee, which is examining among other things, public concerns on animal use and treatment, benefits derived by humans and by animals from that research, scientific and technical developments that may affect the use of animals for experimental research. This includes the use of nonanimal models, and the effects of current guidelines of various agencies, including those self-imposed guidelines, for animal care and use.

In its report, the committee will offer recommendations on the humane and proper use of animals in biomedical research, taking into account both the scientific needs for such research and public concerns about the research. In offering such recommendations, the report of the committee will differ from the recent and excellent OTA report entitled "Alternatives to Animal Use in Research, Testing and Education," which offered a series of clearly articulated options, but did not offer any recommendations about this area. This is an area of very great public concern as you and the other members of the committee are well aware, and one in which scientific needs and desires, ethics, morality, and public standards need to be brought to bear.

The second area in basic biology which I will mention briefly is the Committee on Research Opportunities in Biology, of which I chair. It is one of a series of reports that have been produced under the aegis of the National Research Council which addresses the health of a scientific discipline. The institution, in the past several months as you know, has issued disciplinary surveys of chemistry and physics, as well as examinations of the state of engineering education and mathematics.

I would just point out that the caliber of the individuals who served without compensation on such committees is impressive. For example, the membership of the Committee on Research Opportunities in Biology includes 16 members of the National Academy of Sciences among the 22 members, and I assure you that it includes many of the very busiest people in the field of biology both from industry and from universities who are willingly giving their time to try to provide advise about significant research opportunities for the future.

Now I would like to move on to a few brief comments about the area of international relations and development. There are a number of signals that science and technology are assuming a more and more influential role in international affairs whether they be political, economic or military. For example, the Versailles Summit, where the theme was technology, growth and employment. At the Williamburg Summit, Prime Minister Nakasone of Japan lectured his peers on recombinant DNA, a subject we are all familiar with. There is a recent addition of the Japanese Government on "Human Frontiers," which basically is a massive countrywide effort to incorporate the benefits and advances made possible by science and technology. The competition in global markets for advanced technologies is increasingly evident and increasingly important for the United States.

The efforts of Third World countries who align their industries along more technological lines are also significant; India, China and many other countries are eager to share and receive the benefits of biological and chemical and engineering technologies from the United States, and there are increasing pressures to internationalize large-scale scientific and technological projects, which certainly need careful attention and scrutiny by the Congress, and the administration and the American scientific community, in terms of their bearing on the health and science and technology in America and our international position.

Now the institution's international work through the Office of International Affairs of the National Research Council and the foreign secretaries of the two academies, reflects all of these concerns and the ways in which they are being considered very carefully. A selective scan of some of the work of the National Research Council's Office of International Affairs will indicate something about these.

As examples of overseas programs, for example, the United States-India initiative which came about as a result of intergovernmental agreements encourages collaborative research in four areas:

agriculture, health, materials research, and research on monsoons. With respect to Egypt, efforts to assist that country in strengthening applied work at the National Research Council, and science policy and planning capabilities at the Academy of Scientific Research and Technology in Egypt.

A clear example is a regional workshop on coal utilization as an alternative to imported energy held with three Latin American countries—Peru, Bolivia and Ecuador—in June 1985. With the industrialized world which comprises 25 percent of the world's population using 80 percent of the industrial energy supplies available worldwide and with the search for energy resulting in the relentless destruction of potentially renewable resources throughout the province of the world as people take firewood which is the primary source of energy. There are all forms of study on more efficient energy utilization in the Third World.

In a second area of research grants the Office of International Affairs at the National Research Council, AID funding has made 80 research grants in 28 counties, awarded competitively in six research areas: grain amaranth, tropical trees, which goes back to firewood that I mentioned a minute ago, biological nitrogen fixation, mosquito vector research, rapid epidemiological assessment, and acute respirator infections. These are areas that AID has selected as priority areas for the sustained development in the countries involved and by the setting up of competitive, small competitive grants program under the Board on Science and Technology under the Office of International Activities, they have assured high quality focused research on those areas.

Studies and publications are perhaps best illustrated by the well-known publication of the Advisory Committee on Technology and Innovation, or ACTI. In its 13-year history, ACTI has published 32 reports covering innovations in energy production and use, plant resources, tropical reforestation, tropical animal resources, and many other fields.

For examples, here is a report on "The Winged Bean: A High Protein Crop for the Tropics"; "Leucaena: Promising Forage and Tree Crop for the Tropics"; "Jojoba: New Crop for Arid Lands." In the past 10 years 500,000 copies of these reports have been requested and the academy receives approximately 50,000 additional requests for these reports every year.

The effects are even more remarkable than the distribution of the reports. Hundreds of scientists, farmers and gardeners are developing jojoba, guayule, leucaena, winged bean, and otherwise previously relatively obscure species that have been highlighted by the National Research Council activities, and indeed, more than $200 million is known to have been spent on testing plants that ACTI has examined and brought to public attention throughout the world.

Now, in the area of scholarly communications and exchanges, a couple of brief examples will illustrate the central role of the National Research Council. With respect to China, the Committee on Scholarly Communication with the People's Republic of China, which was a joint activity of the academy and other agencies, has been a prime force in bringing about the present very effective state of interchange with the People's Republic of China. The National Research Council and its constituencies have worked assiduously to improve exchanges, educational opportunities for students and scholars in both China and America and access to field research. There are approximately 15,000 Chinese students that are studying in the United States on programs that have been stimulated during the course of the interchange, and recently the interchange has been even more effectively stimulated by visits from leading scientists from Chinese Academy of Sciences. The officers of our academy will, in the middle of this month, go over and continue the negotiations overall. As a field-oriented scientist who has had some experience conducting field work in China, I can say that the situation has basically returned to a normal one, and one in which we can expect significant scientific, educational, technological and economic returns—not to mention political returns over the years to come.

With respect to the Soviet Union and Eastern Europe, the National Research Council/Academy complex likewise has been effective in keeping some measure of collaboration interchange going in terribly strained times. The continuing informal and unofficial discussions on disarmament, for example, played an important role in influencing policymakers, both in the Soviet Union and American Governments.

Recently, the National Academy of Sciences signed a new agreement on scientific cooperation with the Academy of Sciences in the U.S.S.R. and insisted on a human rights provision, as stimulated by the overwhelming majority of the members of the Academy. All activities under that agreement will be conducted under the principles of the Helsinki accords which are explicitly mentioned in the preamble of the agreement. This, we feel, gives us an opportunity to stay in touch with Soviet scientific and technological developments while still insisting on the principles of human rights which Americans agree must be an important ingredient for all such activities.

With respect to Eastern Europe, our activities have been less publicized but are no less important. The exchange programs with countries like Poland, Hungary, and Czechoslovakia which are very advanced in the field of science and technology, give us the opportunity to stay in touch with developments in those countries and to be able to provide input from their activities to our own scientific technological establishment. The program with the German Democratic Republic, although it is small, is one that is highly desirable because in many ways the GDR is one of the most advanced in all of the countries of Eastern Europe in science and technology yet, unfortunately, it is one with which we have the least interchange and the least possibilities for interchange. It would be highly desirable, in the view of scientists who are interested in worldwide interchange, in developing a more extensive program with GDR.

Obviously I have omitted many things, and I have provided a very quick scan of institutional programs in basic biology and international affairs. But I hope that I have at least made the main point, which is that the activities are important, that they are incredibly diverse, and that their successful execution requires an institution that is independent, that is uniquely suited to obtain the necessary resources from the American scientific and technological community, both the universities and industry, which I think are very important, and those both insist on excellence, and, in insisting on that excellence, have set up mechanisms to protect the excellency in the provision of advice for the administration and the Congress in its chartered role which has become so important, particularly in the years following World War II. Thank you, Mr. Chairman.

DISCUSSION

Mr. FUQUA. Thank you very much, Dr. Raven.

You mentioned student exchange between China. Is that a one-way street or a two-way street?

Dr. RAVEN. It started out primarily as a one-way street. However, privately funded students from China, who are increasing in numbers, remain in the United States in very large numbers, and their contribution to the advancement of science and technology in the United States, like the contribution of graduate students who come from other foreign countries, shouldn't be underestimated.

Furthermore, with the increasing——

Mr. FUQUA. How many do we have going to study in China?

Dr. RAVEN. More and more Americans are going to study in China, but obviously limitations in Chinese language are putting severe barriers on that. However, as I mentioned, I think that the opportunities are becoming more and more open, and more and more American students in biology and geology and social sciences are now being able to get to parts of China that were formerly closed.

Obviously, China is a country where local authority is highly important, and this makes it difficult, even for the Chinese authorities to expedite some of the kinds of research that are desirable. But I think the kinds of research that are going on now, like those that we expect to have with a friendly country, and the opportunities are basically, in principal, unlimited as China gropes for ways to modify its own science policy.

Mr. FUQUA. How about the Soviet Union?

Dr. RAVEN. Exchange with the Soviet Union, obviously, over the past years has been extremely limited, but we are now gearing up for a renewal of the kinds of seminars and exchange possibilities that we had in the past.

It is interesting that over 30 individual activities have been proposed by national seminars, proposed by members of the National Academy of Sciences. Dozens of members of the academy have said that they wish to spend periods of time in the Soviet Union studying, and I think many of us feel that that interchange and the ability it brings with it to understand better what is going on in the various research centers of the Soviet Union, is a very important ingredient in the development of our own science and technology.

It has been a very difficult thing to keep going for obvious reasons, and I personally am delighted that we are able to find some ways to expedite it now.

Mr. FUQUA. Would you happen to have the figures, and maybe you could supply them to us, if the academy has them, of the number of, say, Chinese students who are here, approximate number versus the number of U.S. students who are there?

Dr. **RAVEN**. We will supply them.

[The information follows:]

A recent National Research Council report, "A Relationship Restored," examines trends in U.S.-China educational exchanges for the years 1978–84. Statistics from this report note a dramatic increase in the number of Chinese exchange visitors coming to the U.S., a total of approximately 19,000 students and scholars during the 1979–83 period. Approximately 2,900 to 3,300 American students traveled to China for what the Chinese government considers academic purposes, during the same period. In 1984–85 alone, 10,100 Chinese students came to the U.S.; approximately, 1,600 American students and scholars traveled to the People's Republic of China in 1983.

Mr. **FUQUA**. And the same with the U.S.S.R. and possibly Japan?

Dr. **RAVEN**. All right. We will supply those.

[The information follows:]

In the case of U.S.-Japanese exchanges, approximately 13,010 students from Japan were in the U.S. in 1983–84, while approximately 700 students from the U.S. were in Japan during that period.

Approximately 200–250 Soviet students and scholars were in the United States in 1984–85. No complete compilation is available for U.S.-Soviet student exchanges, however some exchange programs are reciprocal in numbers. The largest exchange program is administered by the International Research and Exchanges Board (IREX) of the American Council of Learned Societies, with approximately 83 advanced graduate students and post-doctoral exchange students from each country in 1983–84. The U.S.-Soviet Academies of Sciences exchanges approximately 15–20 scholars each year. In addition, several hundred undergraduate students from American universities travel to the Soviet Union for educational purposes each year, while few, if any, comparable Soviet undergraduate students travel to the United States.

Dr. **RAVEN**. The order of magnitude in the case of Chinese students is thousands of students in this country, hundreds of students in China.

Mr. **FUQUA**. Yes.

Dr. **RAVEN**. The order of magnitude in the Soviet Union is negligible, and in Japan, of course, you have a different situation since there are excellent opportunities for graduate study in both countries.

Mr. **FUQUA**. I know in many cases the National Academy of Sciences are probably about the only link we have sometimes with that country, and particularly with their scientists. Even during the heights of the Cold War, it was our scientific community that still maintained contact, and that has happened in recent times when there are political flare-ups that somewhat limit the exchange of information, but there have been this, most of the time, exchange amongst the scientists.

How can the academy, now that science and technology is probably getting more and more in the forefront of foreign policy for this country, whether it be the Third World or be with some of the Warsaw Pact countries, strengthen its role in trying to bridge some of the political obstacles that arise?

Dr. **RAVEN**. I think that Congress and the administration need to think about, as you of course do, areas that are particularly important to us and to commission studies and opportunities for interchange in those areas. The fact of the matter is that with many countries of the world, and East Germany, as I mentioned, specifically is a very good example, have virtually no interchange, and yet they are extremely advanced and strong in science and technology.

Programs like the East European program of the Academy, the Soviet program of the academy, the Chinese exchange program of the academy, which are funded primarily through the National Science Foundation, are very poorly funded, and are always the subject for cutting at a time when budgets are scarce. I would say that the protection of funding of international programs of all kinds within the National Science Foundation, and other relevant agencies, would be of direct importance to the academies' ability to promote those interchanges.

Basically an academy that remains in close contact with its counterparts in other countries is an academy best prepared to provide meaningful advice to Congress and to the administration about matters of industrial competitiveness, relative degrees of advancement, opportunities for joint ventures, and the like; and an academy that receives insufficient core funding promoting those kinds of international exchange activities, for sending selected scholars to the countries, and receiving selected scholars, is an academy that is proportionately crippled in its ability to do that.

A recognition of the value of international science is extremely important to the health of the American scientific enterprise. Yet in some strange way, although we all know the central role to which you have alluded, it always tends to be some kind of a secondary activity that could be eliminated when budgets are tight, and I would submit that just the opposite is true, if you look at it in terms of the national interest, short or long term.

Mr. **Fuqua**. How about the commitments within the academy? What help does this international participation get, and I am thinking maybe in the COSEPUP committee? Does it get a high level in there? Are we looking at more day-to-day operations, and I guess what I am saying is, does this get the level of attention that it deserves within the academy through the various committees that establish policy?

Dr. **Raven**. Well, I think yes and no. The subjects that COSEPUP addresses in detail for research briefings, as you know, are selected in consultation with the membership, both by the Presidential science adviser and the director of the National Science Foundation, and of course, are nominated by COSEPUP, and the membership of the academy is screened about suggestions. Certainly both the director of the National Science Foundation, who, in my opinion, is doing an excellent job in this regard and who is very aware of the need for its attention to international interchange and competitiveness, and the Presidential science adviser, now in limbo for the moment, are aware of these issues.

There has been a desire on the part of Dr. Keyworth, at least, to ask relevant parts of the academy to address international positions in various fields. Studies have been commissioned in those fields, but I guess when I sum it all up, I would have to say that in my opinion, the answer to your question is no, not sufficient attention is being paid to the international aspects of the presentations that are generally being called for and made. Increasing attention to the international aspects, and ramifications of those subjects, would be highly desirable and useful for Congress and for the administration in formulating science policy.

Mr. **Fuqua**. How about self-initiated studies now that the academy is moving in that direction?

Dr. **Raven**. Well, I think, when appropriate, they are fully international, and I don't really look on that as a particular problem. I think they span a whole array of subjects and sometimes those are intrinsically international; sometimes they are not, but I don't see that as a particular problem. I think they would be.

I think I would observe that as a group, in my opinion, the officers of the academy are very outwardly looking at international, although it is mainly external. You will, of course, hear from them tomorrow, but I think it is mainly external factors that might limit their possibilities for operating effectively at an international level.

Mr. **Fuqua**. Mr. Brown.

Mr. **Brown**. Dr. Raven, the academy obviously plays a very important role. It has been in existence for a long time. Would you have any suggestions, or has there been any process underway in the academy recently, which would engender recommendations for any major, or even relatively minor, changes in the role that it plays, the way in which it operates, so as to more successfully perform its fundamental mission?

Dr. **Raven**. It, of course, depends on the meaning of the word major. I think there are at least two major trends that are worth mentioning in that context. One is the increasing participation of industry in the academy over the past 10 years, which has already been mentioned. In that respect, I would point out that in the 19th century, and for many years, the academy was a complex of engineers and scientists and technologists, and it was really only in the first several decades of the 20th century that the academy became more of an academic or ivory tower operation.

I think in terms of national needs and realities that the present trend which brings together industry, universities and government in operations like the Government-University-Industry Roundtable, and the increasing participation of industry in the Academy, and of course, in the academic community in the United States generally, is extremely important and although it is not marked by any particular point in time, I think it is an extremely significant trend which does in reality change the scope of what the academy and the National Research Council complex is doing. From my point of view, it is very much of national interest if we are talking about science policy to do everything that we can to strengthen interaction between Government, industry and academia, and to get the best of all of those. That is certainly a significant trend.

I think, on a more modest scale or a more technical scale, there have been significant discussions in the Governing Board of the National Research Council, and in the councils of the academy, about how to provide real-time advice, or advice in shorter time than is possible by our traditional method of preparing reports. The difficulties in that which I alluded to in my earlier remarks are that it is antithetical to reaching a measured decision, a considered decision about items without taking the time to do a complete and comprehensive review. Many of us feel, for what I believe are valid reasons, that that review is the essential part of the academy process, and that any leakage of reports, or implementation of reports, before those reviews are completed is detrimental to the whole operation.

At the same time there are obviously ways in which the Academy can put together committees and individuals which can interact with various committees and Government agencies on an ongoing basis, as long as the conclusions of those ongoing deliberations are not regarded in the same light as those of mature Academy studies. Letter reports are now being made, which can be brief answers to particular questions which can be reviewed rapidly and issued in a period of weeks rather than in a period of years. So I think there is a real agonizing, and many hours of careful thought that have been spent in the National Research Council, and other academy agencies, about how we could provide the kind of advice that people want in a very thoughtful and important way, but in a shorter and quicker time. Otherwise, in my opinion, the participation of the NAE and the NAS in the operation of the National Research Council and the parallel scrutiny of IOM studies are working very well and is very healthy.

I would also mention, I guess, as a third point, that Dr. Press' efforts to raise private funds for endowment for the academy and give it a measure of independence in initiating studies which cannot, for various, mostly political reasons, be commissioned by Government agencies at a particular time, or are not commissioned, are extremely important.

The character of the academy as an intrinsically nongovernmental agency underlines, and makes possible, its ability to provide valuable advice to the Government. I think that, in that respect, and in his streamlining and upgrading of the staff—where I think Dr. Press has played an absolutely marvelous role—has resulted in a smaller, more excellent staff; even better than the very good one that the academy had before. I think those are factors which affect the ability of the Academy to provide the advice the Government asks of it.

Mr. Brown [acting chairman]. You make reference to the increased participation of industry. I presume that this includes both an enhanced role for academy members who are affiliated with industry, and maybe an effort to bring in more such people. Does it also include an enhanced participation of industry in financial support of the academy in addition to the point that you just made about the endowments which Dr. Press is seeking which I presume are basically from industrially funded foundations?

Dr. Raven. Yes, to really all of those questions. There is an ongoing annual participation of industry, like participation of foundations, certain foundations, in the central activities of the academy.

I would like to put on record, in that connection, that every single instance of industrial participation is carefully, in fact, meticulously scrutinized to avoid conflict-of-interest situations, and to make sure that the industry will not have a vested interest in any aspect of the academy operations. Those contributions are all made without any restriction to a particular study, designation, or attitude or bias of the industry being allowed to come into play. Studies which are conducted do not ever involve in the composition of the committees or in the review, interested parties from industry;

but industry sees the academy as contributing in an important way to the development of scientific policy in the country also, so they have, in fact, been willing to give significant sums, both for annual support and for endowment, as have foundations.

Mr. BROWN. Can you indicate the approximate amount of that support for the record?

Dr. RAVEN. We would rather file that with you later, but the approximate amount of the annual support is about $1.5 million from industry.

Mr. BROWN. That is both the endowments and contributions?

Dr. RAVEN. No, that is in annual support. And the contributions to endowment as they may come, but we will provide you with a record of those.

[The information follows:]

The Annual Report of the Treasurer of the National Academy of Sciences lists the total income received from all sources in the fiscal year ending June 30, 1985 as $85 million, of which $1.58 million (or 1.8%) were derived from contributions by private corporations.

Mr. BROWN. I asked that question to sort of lead into a question as to whether or not it would be desirable to consider some more significant structural changes without in any way handicapping the basic function of the academy or its role. And I can envision a number, perhaps a move toward the provision of a Government endowment which would provide larger or more assured sources of funding and whatever the mechanism is, which I gather is somewhat on a project-by-project basis. Do you get any unrestricted grants in aids to the academy?

Dr. RAVEN. From the Government?

Mr. BROWN. Yes.

Dr. RAVEN. We do get core support for some of the activities of the academy from some of the Government agencies that have been supporting them for years, and in some cases they provide core support for the particular committee without reference to particular reports, and in return, expect those committees to produce reports in a general way on subjects of interest to them.

The subject of governmental endowment for the academy is one that has, of course, been discussed from time to time, although I have not heard much discussion of it recently. I would be very, very enthusiastic about such possibilities if they could be realized, and I think that anything that will protect the independence of the academy, but at the same time allow it to operate on a firm financial footing, would be extremely important.

I think the distance from the Government, and the fact the academy is basically a private voluntary organization that gives advice to the Government, is the single most important factor, and the factor that distinguishes our academy, and its various bodies, from the academies of all other countries, and the one that they are all anxious to emulate. But I think if it were ever possible to provide an independent endowment for academy operations, that it would increase in a marvelous way the ability of the academy to contribute significantly to the national welfare.

Mr. BROWN. But you haven't made that recommendation, have you?

Dr. **Raven**. It has certainly been discussed from time to time. We would be delighted to make that recommendation.

Mr. **Brown**. Could you provide any documented reference to previous discussions. In other words, has there been a record in the minutes, or a report made or something of that sort?

Dr. **Raven**. We will provide that.

[The information follows:]

It is my understanding that the Council of the National Academy of Sciences did discuss a proposal for a Congressional endowment to the Academy during 1980 when Philip Handler was President of the Academy. At that time some members of the Council looked with favor on the concept of such an endowment if it did not jeopardize the Academy's independence. Exploration of the feasibility of such an endowment did not go beyond the stage of informal discussion.

Mr. **Brown**. Because after all, the ostensible purpose for this exercise is to look at the next generation of policies in the science field, and I want us to look broadly at that. Another aspect of that might be in this field of international exchanges. I am not at all happy with the way our international scientific and technological relationships seem to wax and wane with the particular winds that are blowing at any one time. I know the academy is also susceptible to these winds on occasion. I remember when you went through the exercise of trying to persuade the Soviets to do something about human rights in the Sakharov case, and I don't know if the academy was particularly successful in that, but neither was the Government. But it is an illustration of common winds that blow.

But I think the academy, by its nature, would be capable of carrying on a more sustained and successful program of scientific exchanges on behalf of the people of the United States if it were insulated to some degree, and had a mandate which ran without regard to a particular administration and so forth.

Dr. **Raven**. The single most limiting factor on the ability of the academy to participate effectively in international exchanges is the necessity of the annually requesting of grants from the National Science Foundation, whose budget is going up and down in the international area, according to the factors you are talking about, and the inability to count on sustained support on a year-to-year basis, just as you have said it, for promoting those exchange activities. Anything that could be done to alleviate that problem would, in my opinion, be a really significant contribution to the welfare of American science and the country.

Mr. **Brown**. You made a very persuasive statement about the significance of these exchanges in terms of developing an ongoing understanding of the scientific and technological developments in these countries, which allows for a better policymaking in this country with regard to security issues, economic development issues, and a variety of other things. I think that a convincing case can be made for a sustained, relatively undisturbed level of such exchanges managed by independent agencies such as the academies. I know it would be opposed, but it could be debated, and conceivably the support for that could be in the majority. It is something I think we should examine in connection with this long-term look that we are making here.

Just one additional point. Am I chairing this meeting now? In that case, I will take one more question before recognizing Mr. Packard.

Early in your presentation you made a statement with regard to the use of animals in research that the OTA report had articulated clear policy alternatives but no recommendations amongst the alternatives. That is the mode of procedure of the OTA and the question that I want to raise to you, and I have raised it many times before, should we look at the possibility of the OTA going a little further than what we have mandated in the legislation, setting it up?

I don't want to prejudge your answer, but I suppose the same sort of question arises in connection with the academy. You make reports. Those reports frequently examine policy alternatives. I am not sure that you always come up with a policy recommendation, and particularly a good policy recommendation, but I am interested in your reaction to the OTA's role in that regard.

Dr. **Raven**. Well, obviously I can only give a personal opinion on these matters. My personal opinion is that the word "Assessment" in the OTA is the operational word and that Congress is better served by having the OTA operate in the way that it operates now, which is to present, as clearly as possible, the result of staff research with input from what individuals can be persuaded to advise the staff, a clear presentation of the alternatives with the consequences of those alternatives, just as similar organizations do for legislative bodies all over the country. I think, that at that level, what Congress needs is a body that will offer the alternatives and the consequences of those alternatives.

On the other hand, with respect to studies by the National Research Council I think that the intensity of the recommendations that may be made will be determined by the nature of the questions that are being asked and posed for the National Research Council. The National Academy of Sciences was specifically chartered in 1863 to answer questions asked to it by the Government, and provide advice about questions, which is really a different scope from the scope of the OTA, as I understand it and believe in it. I think the National Research Council will make recommendations at any level, and at any depth, that it is asked and charged to do. Those may be good or bad, but I would submit, as I have argued, that the system itself is well qualified and well constituted to provide solid advice based on the questions being asked.

I personally am very much in favor of maintaining the dichotomy between the two bodies and feel that both provide useful in products.

Mr. **Brown**. Mr. Packard. I apologize for taking too much time.

Mr. **Packard**. No, in fact, one of your questions related to one that I wanted to ask, and that was: what are the impediments—political, funding, cultural, language—that are primary impediments toward international cooperation and joint venturing in our academy of research programs?

Dr. **Raven**. I think that the two primary ones with those that I have mentioned, or that have been mentioned in the earlier discussion, funding is a very serious impediment. For whatever reason, international scientific exchange and cooperation does tend to be looked on as a luxury, even when areas such as the development of science and technology in Third World countries, for example, and the consequent stabilization of the economy and the political situation in those countries could be a very great importance to us. Nevertheless, those international activities always tend to be looked on as rather a luxury and be defunded in times of budgetary stringency.

Second, I think equally obviously, the difficulties do tend to be political. One always views, with appropriate care, the possibility of losing our own science and technology to other countries in the course of interchange. Certain safeguards need to be employed to see that that doesn't occur, but I think in the view of the scientific and technological community, as represented in the academies and the National Research Council, those safeguards can be taken, the interchanges can be understood clearly, and the benefits of learning about what they are doing greatly outweigh the risks of losing technology at an unpredictable rate through the interchanges themselves.

So I would say the main impediments are financial and political.

Mr. **PACKARD**. Some countries, obviously, are more cooperative than others. Do Third World countries, are they many times, as much or more cooperative than some of our major countries? Or do we find most of our international cooperation with some of the primary friendly nations, France, England?

Dr. **RAVEN**. Well, our heaviest and most significant and longstanding cooperation, of course, is with countries like Canada and Britain, and Japan to a growing extent, and with the other countries of the common market.

Third World countries tend to be rather cooperative about these ventures, but their own economic situation in the development of science and technology in Third World countries tends to be at such a low level that the net effect of the cooperation, or its importance for the United States, tends to be quite different from that of cooperation with the Common Market, for example.

Eastern Bloc countries and the Soviet Union are, of course, the ones that are most difficult to generate the right kinds of formula for effective interchange, and some of the most important for us.

Mr. **PACKARD**. Is that primarily because they are so reluctant to share information and to communicate? The recent nuclear accident there in Russia, for example; it would appear to me that that could become an extremely effective and helpful learning experience for the entire world science community to review and evaluate the effects of radiation, and all of its variations, and all of its ramifications, and that we could greatly profit from this experience, even though it has been a tragic experience. That apparently is not very achievable because of the closed general communicative pathways there in that Eastern Bloc country.

Dr. **RAVEN**. What the ongoing efforts of the international activities within the National Research Council seek to do is by having significant ongoing interchanges in disarmament, and in other scientific and technical areas with those countries, to create a climate where that kind of highly undesirable situation wouldn't arise, where they would feel secure, and where it would be a normal matter to share the technical aspects of what went on, which certainly, there is no question, that you are absolutely right that we would all benefit greatly by knowing as much as possible about the details of what went on. But in order to make that come about, I think we need to emphasize normal, ongoing, year-by-year, month-by-month interchange, properly funded, sustained and serving to some extent the interest of both the parties, and then I think we will find a more effective interchange.

The example of China, I think, illustrates that very clearly. I don't think anyone in the United States would have dreamt in 1970 that there could be the kind of intensive scientific and technical interchange that there is between China and the United States at the present time, with all of its tremendously significant economic and political properties. And yet that has come about, I would say, in part because of the sustained and effective interchange activities generated by the academies. I would say the same kind of activity could bring about the same kinds of desirable effects, given enough time and care, with any country in the world.

Mr. PACKARD. Are there international agencies that coordinate and help set up international cooperative ventures and activities with the academies, or is that left to one country with another on a one-to-one basis?

Dr. RAVEN. It is almost exclusively bilateral.

Mr. PACKARD. So there are no international groups or organizations that are designed to try to facilitate cooperative activity?

Dr. RAVEN. Not at the level of academies, not really.

Mr. PACKARD. We have them, of course, in almost every other phase of international relationships, and apparently in academia we do not.

Dr. RAVEN. Well, I stress again that our Academy is a very peculiar animal. On the world scale, there are very few parallels anywhere in that we have a scholarly society of people elected by virtue of their excellence who in turn generate something like the National Research Council, the whole apparatus being distinct from Government, providing advice to Government. So, in fact, our opportunities for interchange with other academies or similar bodies is very much limited by the fact that they are normally either operational arms of Government, or politely sort of totally honorary sort of organizations with no real relevance in terms of conducting studies. So it is difficult to find counterparts at that level for interchange.

Mr. BROWN. Would the gentleman yield?

Mr. PACKARD. I would be happy to yield.

Mr. BROWN. I think to expand on that discussion a little bit, however, it should be noted that we do have in the scientific sphere a host of international organizations. These scientific organizations will generate large-scale scientific projects which then the scientists of individual countries or the governments will participate in. We have, for example, the International Geophysical Year Project, and some that are in the mill now, like the international biological whatever the heck it is, the study of the earth as a whole. As you point out, the academy, per se, is not directly involved in these matters, but the scientific community as a whole and the Academy as a part of that community are involved.

Dr. Raven. Very definitely. I was making my answer on a much more limited grounds, and of course, it is worth mentioning that the support of those organizations, which has partly deteriorated as a result of the United States' withdrawal from UNESCO is a matter of extreme concern and is something that the committee, I am sure, will address.

They are subject, our membership and participation in those international activities, obviously are subject to the same kinds of pressures brought about by vacillating funding, and the necessity for the academy to request funds year-by-year from an NSF that regards these as marginal activities, and they are extremely important.

I was talking only on the very narrow level of actual coordination of academies.

Mr. Packard. You mentioned the uniqueness of the academies. It is a different animal, and do we find in most of the foreign countries, particularly those with which we do have interchange, that they have this same unique academy structure, or do they have a little bit different structure, or does each country have a different kind of academy arrangement?

Dr. Raven. Generally they are all, each one is unique. The French academy, for example, is essentially purely honorary, has a very limited membership and no operational capabilities at all. The Royal Society in Britain, which is the oldest of the academies and which goes back to the 17th Century, provides studies and advice to government, but at the rate of a few studies per year, not at the rate of about one per day, which is about the rate of productivity of our National Research Council. And it has no separate body, like the National Research Council, by means with which it can coop the British scientific and technical establishment into its studies.

The Soviet academy, on the other hand, is a huge operating branch of government, which has research institutes all over the country, which are really part of the academy and is another wholly different kind of an organization.

So I think each one is unique and set up by the standards of that particular country.

Mr. Packard. Do these differences and different capability and structure, does that interfere with the ability for our academies to work on a common basis with them, or does that seem to add just to the flavor of international cooperation?

Dr. Raven. I think it is no problem. There are always counterparts that one can interchange with, whether they be part of a particular academy complex or not, and we are able to do that, given the financial support and political situation with any country in the world. The interchange may or may not be with the academy, but interchange is widespread and important.

Mr. Packard. One last question, Mr. Chairman, and that is a followup of this.

In reviewing the unique qualities of other foreign academy systems, are you satisfied that our own unique structure is structured best to fit our environment in this country's intents and goals, or do you see some structural arrangements in some foreign countries that would be very beneficial to our own structure?

Dr. RAVEN. Obviously, it would be very foolish to say that our situation is perfect, but it would be equally foolish not to regard the fact that most countries in the world are avidly studying our own setup, which is generally regarded internationally as the best model for a set of academies and for providing objective advice to the Government to be found in any country in the world. I think you will find agreement on that, even with a set of international witnesses. So, overall, I think we have something very fine and something that we can all be very proud of in our academy complex.

Mr. PACKARD. Thank you, Dr. Raven. I sincerely appreciate your testimony. It has been a pleasure to hear you.

Mr. BROWN. He is saying the academy is sort of like our system of Government. It is not very good. It's just better than anything else.

Mr. Packard, neither you nor I had an opportunity to hear Mr. Coleman, who I understand is still here. I would like to ask him if he would come up for a few minutes and let us badger him, if he is still here and is willing to do so.

He is here, and I guess he is willing.

I apologize, Mr. Coleman, for not being here when you made your presentation, and I understand that you don't claim any current expertise on what is going on at the academy, but I thought I would ask you to respond from your own viewpoint on a couple of the questions I directed at Dr. Raven.

Are we at a period in which we could look to some fairly significant changes in the operations of the academy that might enhance its value to the country and to the Government, as for example, some change in the method by which the Government funds its part of the academy's budget, or through some process by which it would have some additional autonomy in the handling of, say, scientific exchanges? I am searching for new and innovative approaches to problems, recognizing that the academy is almost perfect, but could we do something to enhance it?

Mr. COLEMAN. Well, there is a long and short version in response to that.

Mr. BROWN. Could you bring the mike up a little closer to you?

Mr. COLEMAN. Yes.

Let me say the Academy exists in a pattern of scientific organizations in this country, which is relatively recent. I would say at the time the academy was formed in 1863, there were essentially no other scientific organizations, a few perhaps; now there are literally thousands. These serve primarily the professional needs of several disciplines.

The American Physical Society exists largely to communicate the results of individual to the community of physicists. On occasion they initiate studies and they can be very valuable. The Physical Society study on energy, I think, is a very good study. It was self-initiated, and I believe self-financed.

The academy, I think, has always had money problems, if you like. These are somewhat lesser now if you looked at the history of the academy's budget; it has gone up from 1946, when I first joined the staff as a committee secretary in the National Research Council—I would say it has gone up by a factor in dollars of 40 or 50 times.

Mr. **Brown**. Real dollars or funny dollars?

Mr. **Coleman**. Current dollars, current at the time. That is, absolute dollars. If you correct that for inflation, perhaps it is eight times. The same thing has been true of staff; same thing has been true of the number of committees of the range and scope of jobs.

In the course of this, I think there have been several efforts by the presidents and the council of the academy to examine the question of Government funding. There has always been the concern that the academy, no matter what mechanism was used, would lose a certain amount of independence, which is precious to the members of the academy and I think precious to the Government.

The last debate I remember on this topic was, I guess, ran for two or three years, and the closest thing we could find to a more stable form of Government funding would be in terms of an endowment. That is relatively unrestricted within the charter of the academy.

Even that, I think, raised great debates, support among many members of the council, not the majority. There were always concerns that by being dependent, particularly if it was a year-by-year or a 5-year grant, that somehow we would become an instrument of the Government, rather than an instrument of the scientific community—a special instrument, set up to assist the Government.

But the integrity, the quality, I think, they felt could be enhanced by some such support as an endowment. I personally take the view that I think an endowment would be useful, but it would have to be a permanent endowment, and it would have to be unrestricted, and I don't think it should exceed the private endowment.

One of the arguments made was because the academy, if you look at the total number of professional staff and facilities it has, these are 80- to 90-percent devoted to Government response. However, the base, the endowment is all private, and the argument was perhaps there should be a sharing of that endowment by the Government in recognition of the need to have in place the ability to respond more quickly and perhaps with better quality than if you have to do it on a project-by-project basis.

Mr. **Brown**. Are you saying, Mr. Coleman, there is currently a private endowment, unfettered, unrestricted, that the academy can use for base support?

Mr. **Coleman**. Yes, sir.

Mr. **Brown**. And you are suggesting that any Government endowment should not exceed the amount of that.

Mr. **Coleman**. That is my own personal view.

Mr. **Brown**. And should be equally unrestricted and unfettered?

Mr. **Coleman**. That is my personal view, yes, sir.

Mr. **Brown**. I am thinking of the endowments of some of our great institutions such as Harvard and so forth. None of these are completely unrestricted. People who leave funds frequently like to tie them up and say they shall just be used for one purpose or another. You wouldn't like that?

Mr. **Coleman**. Well, we have gifts that have come to the academy. For example, the Day Fund, which was willed to the academy by a former member, as primarily for support of the earth sciences.

I don't think it is regarded by the academy in its bookkeeping as an endowment. I think it is regarded as a special fund. But the major endowment of the academy came Carnegie back at the time the academy building was put together in the early 1920's.

Mr. BROWN. I think that we ought to look at that issue, and if we can get some further information that would enable us to at least study it intelligently.

What about the other thing that I mentioned, a larger role in certain activities involving, basically, the scientific community, such as communication exchange with scientists of other countries?

Mr. COLEMAN. Let me expand on the earlier question just a little. I think if the endowment were restricted, it could be set up as a fund. On the other hand, I think what is needed most is stability, as Dr. Raven pointed out. These vary year by year depending upon the way the winds are blowing. If grants were made longer term, 5 years or 10 years, this wouldn't solve the problem, but it would certainly help.

Mr. COLEMAN. Mr. Packard, are you moved to ask any questions of Mr. Coleman?

Mr. PACKARD. I would like simply to have Mr. Coleman elaborate just briefly on a comment or statement made regarding the tendency of the academy not to be able to timely finish their projects or their research, to do it in a timely way. Sometimes it goes on and on, and I would like for you to just restate what your feelings were on that.

Mr. COLEMAN. Well, it depends I think very largely on the nature of the question and the urgency of the question. There have been major problems brought to the academy by the Congress or the agency of the executive branch, which were important and urgent, in which case the president and the council of the academy become more greatly involved, in both recruiting and in working with the study.

For example, in the CONAES Study, which was an extraordinarily difficult job, lots of political overtones, the chairman of that group, Harvey Brooks, I am sure, spent more time with us than he did with Harvard, his employer. And a great deal of time was expended in holding public hearings because of the nature of the question, nuclear power and alternative systems, and the getting a report that had page after page of, let's say, exceptions or dissenting opinions, all of which were faithfully reported, complicated it.

On the other hand, I can remember studies that we have done. For example, one in the area in which I joined the academy, of naval warfare, where we assembled a group and in 3 months did a study which led to the whole Polaris Submarine Program, plus some other things. That was done in 3 months, as I mentioned earlier, in this particular case because the principals were involved both in the operating Navy and particularly in the laboratories. The recommendations were implemented before the report was printed, so it depends, I think, on the nature of the question, the level of sophistication available to the academy when the question is first raised as to how fast you can do this.

Now, we have instituted a very extensive system of report reviews. This has been probably slowed down the delivery of the report. I think it has also improved the quality of the report. In most cases, however, if there is good communication between the agency making the request and the academy's mechanism for responding to it, that the substance of the recommendations is available to the Government long before the printed report ever hits the street.

Mr. PACKARD. There is unquestionably a dilemma we face, not only on scientific projects but on always every phase of government as to quality of work versus the timeliness, the slowing down process; the more regulated, the more we require the longer it takes, and generally the more expensive it is.

Mr. BROWN. That is the quality.

Mr. PACKARD. Well, the intent is to improve the quality or the environment or whatever our objectives are. You are right, many times we don't improve the quality, we simply increase the cost and increase the time, but that is a dilemma I guess we face in almost every phase of Government, is to what extent should we try to facilitate, to speed up, to improve, without increasing costs or other factors beyond acceptability.

I don't have any other questions, Mr. Chairman. I appreciate the chance to be here.

Mr. BROWN. Mr. Coleman, I am intrigued that you mentioned the Polaris study. I wasn't aware that the academy was involved in that. Is it conceivable that it was so long ago that I wasn't in Congress.

Mr. COLEMAN. It was done in 1956, Mr. Brown, and it came about because of a request of the then Chief of Naval Operations, Admiral Burke, for advice on what to do about a Russian nuclear-powered submarine. At that time the *Nautilus* had been commissioned and had gone through exercises with the Atlantic Fleet, and the Chief of Naval Operations was appalled, they couldn't lay a hand on her. So that was the question.

As I said in my earlier testimony, one of the responsibilities of the academy is to figure out what is the right question, and a group was formed, not to devise any submarine warfare means of sinking a Russian *Nautilus*, but the impact of nuclear power on the Navy's operations, and its planning. And as a result, we, in effect, told the Navy that there is not very much you can do about a nuclear submarine, particularly if it is a missile launcher, rather than an antishipping. But we know a lot more about submarines and we should know more about oceanography than I think we did, and we should capitalize on that.

But the missile launch was a real problem. The current Navy program at that time was to put a *Nautilus* missile in a submarine that had a diameter of 60 feet, and because of the buoyancy requirements, submarines obviously could not operate in any U.S. channels.

It also involved a submarine that was going to be on the order of 60,000 tons. Our approach was to bring together the people in guidance, in warhead design, and all the other specialties that you need for such a system, together with the people in the Navy who were responsible for either designing or procuring such systems, to see what could be put together in some time scale using a quarter-or a megaton warhead.

The design we came up with was 22,000 pounds instead of 300,000, which meant you could use a conventional-sized submarine, nuclear powered, for this purpose. The Navy had in place, under Admiral Raborn, a special project. He attended many of these meetings, and as I say, before the report was done, the Navy threw out its old program and put the new one in.

Mr. Brown. Do you remember who the commander of the *Nautilus* was.

Mr. Coleman. I think it was Anderson, but I am not positive.

Mr. Brown. It was a prominent citizen of San Diego. I thought Mr. Packard would be interested. At the time he was not an admiral, but he retired as Admiral Wilkinson.

Mr. Packard. Yes, I know of him.

Mr. Coleman. Yes.

Mr. Brown. How long would it take you to do a similar study study, like an SDI study?

Mr. Coleman. Well, SDI is a little bit different problem, probably 3 years.

Mr. Brown. Well, we won't need it by then. [Laughter.]

Mr. Brown. Thank you very much, Mr. Coleman.

The meeting is adjourned.

[Whereupon, at 11:30 a.m. the the task force was adjourned to reconvene on Thursday, May 8, 1986 at 10 a.m.]

THE ROLE OF THE NATIONAL ACADEMIES

THURSDAY, MAY 8, 1986

House of Representatives,
Committee on Science and Technology,
Task Force on Science Policy,
Washington, DC.

The task force met, pursuant to call, at 10 a.m., in room 2318, Rayburn House Office Building, the Hon. Don Fuqua (chairman of the task force) presiding.

Mr. Fuqua. Today, we conclude our 3-day series of hearings by the Science Policy Task Force on the subject of the role of the national academies.

We are honored to have with us for this final day of hearings, the presidents of three academies, Dr. Frank Press, Dr. Robert White, and Dr. Samuel Thier. Dr. Press and Dr. White have had a long and fruitful relationship with this committee, and we are looking forward to working with Dr. Thier and the Institute of Medicine.

The impact on national science policy which the national academies have made over the 40 years since the Bush report have been of profound importance. The contributions to the resolution of a wide range of problems of a scientific, technological and medical nature have always been significant and frequently critical.

Our task force is now taking a look ahead, not to the next year or the year after that, but towards the long-term future. What should the relationship between the Federal Government be in the post-Gramm-Rudman era of the midnineties and into the next century?

We look forward to hearing the views of these distinguished witnesses on this subject and to our discussion with them after they have presented their prepared statements.

Following them we will hear from Dr. Denis Prager, who is now with the MacArthur Foundation in Chicago and who formerly was a close observer at the highest level of Government of how the advice from the academies is used.

We regret that Dr. Allen Puckett, a distinguished engineer who is president of Hughes Aircraft Co., will not be able to join us.

Mr. Fuqua. We will start with you, Dr. Press, and then proceed with Dr. White and Dr. Thiers.

[A biographical sketch of Dr. Press follows:]

Dr. Frank Press

Frank Press, president of the National Academy of Sciences in Washington, D.C., has advised four presidents on scientific issues and has made pioneering contributions in several fields. He has been named most influential American scientist in annual surveys by U.S. News & World Report three times, most recently in 1985.

He is recognized internationally for his study of the sea floor and the earth's crust and deep interior. He has also made contributions in geophysics, oceanography, lunar and planetary sciences and natural resource exploration.

Press helped bring about the International Geophysical Year, the first worldwide attempt to measure and map various geophysical phenomena. As a result of the decade-long international explorations of Antarctica and the oceans, Mt. Press in Antarctica was named after him.

In 1977, Press was appointed President Carter's science advisor and director of the Office of Science and Technology Policy. He served on science advisory committees during the Kennedy and Ford administrations and was appointed by President Nixon to the National Science Board, the policy-making body of the National Science Foundation.

Press participated in bilateral science agreement negotiations with China and the Soviet Union and was a member of the U.S. delegation to the nuclear test ban negotiations in Geneva and Moscow.

Born in Brooklyn, New York, in 1924, Press graduated from City College of New York with a degree in physics and received advanced degrees from Columbia University. He joined Columbia's faculty in 1952 and three years later was appointed professor of geophysics at the California Institute of Technology. He joined Massachusetts Institute of Technology in 1965. In 1981, Press was named Institute Professor at MIT, a title reserved for scholars of special distinction.

He is the author of 160 scientific papers and co-author of the textbook Earth, widely used in American and Foreign universities.

STATEMENT OF DR. FRANK PRESS, PRESIDENT, THE NATIONAL ACADEMY OF SCIENCES, AND CHAIRMAN, THE NATIONAL RESEARCH COUNCIL, WASHINGTON, DC

Dr. PRESS. Thank you, Mr. Chairman. I have some brief prepared remarks but I have a more extensive written version for the record.

Mr. FUQUA. We will make the lengthy remarks part of the record in the case of all the witnesses.

Dr. PRESS. Thank you, Mr. Chairman.

Before I go to the main part of my testimony, I want to offer an appreciation to the chairman. This may well be my last formal appearance before him, so I will take a little of your time to voice my admiration. In leading the Committee on Science and Technology, he has made all of us see what was truly essential: that if the Federal Government were to support science then it had a right—and an obligation—to see that Federal research programs were shaped to national goals.

He has has acted upon that insight with integrity, energy, force, fairness, and good humor. We will miss him.

Mr. FUQUA. Thank you.

Dr. PRESS Let me now turn to the purposes of today's hearing: the roles of the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council. That is very large territory to cover and so we have split it into three parts. You will hear from Drs. White and Thier on the roles and agendas of their respective organizations.

I think it may be most useful for me to highlight the recent history of our relationship with the Congress, the impact of what we are asked to do, and some matters of concern for the future.

As to recent history, it is obvious that the links between the Congress and the institution—the National Research Council, the academies, and the Institute of Medicine—have grown steadily in the past 15 years.

In the 1970's issues that the Congress asked the institution to examine included the potential effects of increased carbon dioxide in the atmosphere, the effects of herbicide use in Vietnam, the biological effects of ionizing radiation, water quality, the effects of chlorofluorocarbons on the stratospheric ozone layer, and the risks and benefits associated with the use of saccharin.

The pattern continues. While congressional requests were, and continue to be, a small fraction of the institution's work they are also among its most significant. Thus, we have recently completed or are doing major studies requested by Congress. Examples include an examination of the 55 mph speed limit, the hazards of aviation posed by wind shear, and many more.

What is the impact of what we do? Are our reports used? Are they effective?

These questions are at once simple and difficult. The path between analysis and policy is rarely direct. It must march across contending constituencies and committees, elections, changes in administration and in agency leadership, budget cuts, sudden shifts in the political winds, and the like.

Despite these caveats, one can deal most directly with questions about impact by looking at interactions between the Congress and our institution within the past year.

Our reports are indeed used. Our reports on the state of mathematics and chemistry, on the need for new facilities for materials science, and on space-based oceanographic studies have all had a substantial impact on the fiscal year 1987 budget proposed for congressional consideration.

Debates in the Congress and the administration are informed by our recent work on issues such as the "nuclear winter" hypothesis, the links between academic research and national security controls, the problems of low-birth-weight babies, enhancing our international economic competitiveness, the complexities of the acid rain problem, the need for a coherent research program on highways, new technology transfer mechanisms, the future adequacy of scientific and engineering research personnel, science and mathematics education for elementary and high school students, and policies for an aging society.

Are our reports effective? That is answered, I think, by the recent legislative record. Thus, in 1985, studies have been requested by the Congress of issues such as health care for the homeless, allied health professionals, error rates in welfare programs, and the establishment of a Council on Health Care Technology.

Appropriation actions traceable to our suggestions include increased support for astronomical sciences, recommendations that the National Institute of Mental Health increase its support of predoctoral researchers, the establishment of a center for injury control, and support for work on continental drilling and the International Geosphere Biosphere programs.

Further, last year 43 individuals representing committees of the National Research Council and the Institute of Medicine testified before the Congress. Seventeen special briefings were held for congressional staff and members, on topics as diverse as the Parkfield earthquake prediction, the toxicology information program, ecology and environmental problems, and medical technology. We provided direct advice to congressional committees on Soviet space science, serious flaws in immigration statistics, the relation of epidemiology and air pollution, and other issues of concern.

Let me now offer some observations on the future course of our institution. As in the past, that will be shaped by various pressures, some beyond control. By now, the members of this task force are quite familiar with those pressures, but it may be helpful to highlight those that I believe are major. Drs. White and Thier, in discussing engineering and health care respectively, will amplify my listing.

First, we have a congeries of effects owing to secular limits on the growth of research support. These include:

Greater pressures to set priorities among research fields. This can only be done with the participation of policymakers after a full presentation of the progress and opportunities in the cognizant fields through research briefings and other instruments.

Ever more distressing evidence that our research structure is aging as facilities become obsolete and instrumentation outdated. While the problem is acknowledged by the Congress and, in particular, in initiatives by Chairman Fuqua, remedies remain few and inadequate. the outlook is bleak.

Steady erosion of the diversity of funding instruments and research locales that are two pillars of American science. We may see—directly, through the use of institutional grants, and indirectly, through smaller grant sizes and shorter tenures—further weakening of the investigator-initiated project grant—the sine qua non of first-class research.

More intensive efforts to internationalize "large science." The attractions are obvious, but the deeper implications must also be understood. Each proposal should be evaluated on a case-by-case basis.

The allure of a research career may continue to dim, especially in biomedical research, where prospects for support and for faculty appointments are scant. Thus, graduate enrollment of science and engineering students is slowing. An increase of less than 1 percent is estimated by the NSF for 1985, compared to an average 2 percent increase from 1977 to 1983.

Second, we have the acknowledged relevance of science and technology to national goals, including improving our strength in the international economy and in national security. That epiphany will show up in various ways:

Continuing efforts to put science to work, to boost the links between scientific and engineering research and industrial innovation. We are well started on that road already and, indeed, I think we now do it better than anyone else. At the same time, we need to spark even more relationships, especially in those fields that are essential to advanced technological competition and susceptible to fundamental inquiries.

An increasingly utilitarian view of basic research. Paraphrasing Orwell, we tend to believe that all basic research is good, but that some is more useful than others. The danger is in creating an underclass of research in those fields whose utilitarian purposes are not immediately obvious and whose arguments for support are weakened accordingly. Yet, we know that basic research is serendipitous, and that often the greatest discoveries occur in fields quite remote from eventual application.

Third, I believe we may see—or better, should see—changes in the interactions between science and Government. This task force will have its own list, but I would emphasize the following:

The communication between science and public policy needs to be improved. That the importance of science and technology to national welfare is now universally acknowledged does not lessen the frictions. The poor understanding of the mechanics of the relationship between science and the economy leads to dubious arguments, unmet expectations, and frustrations.

The tensions of scientific freedom and national security need better resolution. Our strength is that we do research better than anyone else and, if we lose that superiority, then all of the rules, regulations, decrees, or national decision memorandums will not help.

The Dickensian tangle of rules and regulations confronting the researcher seeking a grant needs cutting. Efforts to do so are underway in the Florida demonstration I referred to earlier. However, the process needs to be accelerated.

Keeping the above in mind, let me suggest some implications of the work of the institution, especially the National Research Council:

The rate of congressional requests to the institution may continue to rise, as will their inherent difficulties. As I have mentioned, the relation between science and the economy is complex, there are ever greater pressures to use limited resources more effectively, and the Congress, and the administration, must find some transposable way of choosing budgetary priorities among scientific and engineering research fields.

The institution will continue to be pressured to balance the need for rapid studies against the need to obtain funds, negotiate contracts with agencies, form ad hoc committees of volunteers and the like.

The budgetary pressures may affect our volunteer system as the exigencies of maintaining research support at a home base reduce the time available for public service.

Our resources for conducting independent studies, initiated and supported without Government involvement, will continue to be constrained. While we have acquired more funds from the private sector for such studies in recent years, the greater competition for such funds may begin to reduce our capacities to do those studies which we feel are essential but which Federal agencies, for various reasons do not.

Mr. Chairman, and members of this task force, this completes my testimony. I hope it is not immodest for me to assert that the National Research Council is perhaps the most powerful technical advisory apparatus available to any government in the world. That this is so is not just a tribute to the scientific and technologically community, it is a tribute to a Government that understands that the world is not simple, that to govern means to choose wisely, and that one can only do that by understanding. It is the role of our institution to assist in that understanding, and to inform the difficult choices which must be made. We will continue to do that whenever called upon.

Thank you.

[The prepared statement of Dr. Press follows:]

TESTIMONY

by

Frank Press

President

The National Academy of Sciences

and

Chairman

The National Research Council

to the

TASK FORCE ON SCIENCE POLICY

Committee on Science and Technology

U.S. House of Representatives

May 8, 1986

Rayburn HOB 2318

Mr. Chairman and Members of this Task Force. Before I go to the main part of my testimony, I want to offer two appreciations. One is to the Chairman. This may well be my last formal appearance before him, so I will take a little of your time to voice my admiration. The Chairman has understood and acted upon the centrality of science to national strength and welfare. He understands fully what science policy is: the efforts of the federal government to support, promote, and use the scientific capabilities of the United States for national purposes. In leading the Committee on Science and Technology, he has made all of us see what was truly essential: that if the federal government were to support science, then it had a right -- and an obligation -- to see that federal research programs were shaped to national goals.

He has acted upon that insight with integrity, energy, force, fairness, and good humor. We will miss him.

My second appreciation flows from the first. It is for this Task Force, which the Chairman was instrumental in launching. It has not been easy. It has demanded much work and time. It has, I'm sure, tried everyone's patience at times. But, just as an unexamined life is not worth living, so a policy unconfirmed by examination is not worth supporting. I look forward to the Task Force report and to commenting on it.

Let me now turn to the purposes of today's hearing: the roles of the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council. That is very large territory to cover and so, as Caesar did with Gaul, we have split it into three parts. You will hear from Drs. White and Thier on the roles and agendas of their respective organizations.

In my testimony, I will provide some very brief background first, then look at the current status of the institution*, especially the National Research Council. That will serve as backdrop to a discussion of future problems and outlook. I will conclude with issues relating to the institution which the Task Force might consider.

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* Throughout, "institution" refers to the four major organizations that form the Academy complex: the National Academy of Sciences, the National Research Council, the National Academy of Engineering, and the Institute of Medicine.

I can abbreviate the background in part because of two documents made available to the Task Force. One is *A Chronicle of Public Laws Calling for Action Under the Charter of the National Academy of Sciences*. It lists legislation enacted from the 86th through the 98th Congresses (1959-1984) which calls upon the Academy and its associated institutions to perform certain tasks. The second background document is one prepared at the request of the Task Force: *A Compilation of Institutional Studies from 1948 through 1985*.

The National Academy of Sciences was brought into being in 1863 by a Congressional Charter. That Charter provided for uncompensated services to the government on "any subject of science...whenever called upon." It made the Academy an institution separate from the government and from any particular department within it. Until World War I, the governmental work of the Academy was infrequent and, at times, curious, including such things as a confidential report on means of distinguishing calf's hair from woolen goods.

Wartime pressures made scientific advice imperative and the limitations of the Academy -- principally, its relatively small membership -- evident. The National Research Council was created at the request of President Wilson as a "commons room" device to widen the catchment of experts beyond the membership of the Academy.

The limits on Academy membership -- in this case, that election is for distinguished contributions to science -- seeded the creation under the Academy's charter of two other institutions: the National Academy of Engineering in 1964 and the Institute of Medicine in 1970. As I have already noted, you will hear more of the purposes and agendas of these two institutions from Drs. White and Thier.

But let me say a few words on overall governance. As the Chairman and this Task Force know quite well, all institutions can become set in sclerotic patterns. Scientific organizations are no exception. In that light, the creation of these new institutions -- the National Research Council and, latterly, the National Academy of Engineering and the Institute of Medicine -- has strengthened and rejuvenated the nation's premier source of advice on science, technology, and their relation to national policy. The institution has, by virtue of their presence, become more ecumenical in its perspective and more effective in responding to the very difficult requests posed to it. The strength of our technological capacities has become a major issue for the nation -- and, therefore, for the

Congress. The rising costs of health care, our ability to provide it equitably and efficiently, and the wise use of new technologies in dealing with illness are again major elements in national debate. That the institution can examine those issues effectively is attributable to the addition to the Academy structure of the National Research Council, the National Academy of Engineering and the Institute of Medicine.

These parts -- old and new -- are meshing remarkably well. In concert, we govern the National Research Council, the locus for all studies of the National Academy of Sciences and the National Academy of Engineering. The Institute of Medicine conducts its own studies, but the acceptance of those studies involves approval by the Governing Board of the National Research Council and quality endorsement by the Report Review Committee, also of the National Research Council. Each institution has its own interests, but we are also partners. We share the responsibility for governance and we share the responsibility for our work.

Against that institutional background, one sees some major patterns of interest to this Task Force.

The kinds of studies done by the institution for the government have changed.

In contrast to the reports focusing usually on fairly narrow technical and scientific matters, of the sort done after World War II, we more frequently now do reports embracing virtually every field of science and engineering and also steeped in policy issues. In 1985, the institution issued some 300 reports on topics whose range defines a good part of the Congressional agenda; for example, *America's Aging: Health in an Older Society; The Competitive Status of the U.S. Steel Industry; Immigration Statistics: A Story of Neglect; Meat and Poultry Inspection: The Scientific Basis of the Nation's Program.*

The point is not that we are busy, but rather that our work is ever more embedded in issues central to the work of the Congress and, therefore, of the nation. Another point -- well known to this Task Force -- is that, with the infusion of policy into our studies, has come imprecision. It is easy to be declarative on standards for line spectra or adhesives and sealants or solid-earth geophysics. It is not so easy to find certitude in examining issues in global nutrition, the relation between population growth and economic development, reconciling the freedom of academic research with considerations of national security, the causal links between the generation of electrical power and acid rain, or the relationship of diet and cancer.

This Task Force knows full well why the latter issues are so refractory. Data are incomplete. Or they are inadequate. Or they are wrong. Or the theory into which the data can be fitted and interpreted is weak or absent. A purely technical analysis invites naive conclusions. And it often fails to offer the sorts of suggestions needed for informed policy decisions. Yet, an analysis too strictly tempered by economic factors and other elements invites flawed conclusions. More can be said, but I think that the sorts of issues which the institution deals with increasingly are simply not amenable to simple answers. Our responsibility will remain to assert that complex questions yield complex answers, and arbitrary remedies uninformed by competent judgment yield great costs, dubious results, and a confused and at times disillusioned electorate.

Links between the Congress and the institution -- the National Research Council, the Academies, and the Institute of Medicine -- have grown sharply in the past decade.

The very first contract between the Congress and the National Academy of Sciences was arranged exactly 100 years after the Academy was given a Congressional Charter -- in 1963, at the initiative of the predecessor unit to the House Committee on Science and Technology. That contract derived from a request to the National Academy of Sciences from Representative Emilio Q. Daddario, then Chairman of the Subcommittee on Science, Research, and Development, of the House Committee on Science and Astronautics. Mr. Daddario was seeking a comprehensive study of those aspects of policy that the government must consider in its support of scientific research. The resulting report, published in 1965 under the title of *Basic Research and National Goals*, examined the principles underlying congressional allocation in support of science.

A Member of Congress described the report as "a significant milestone in congressional methods of gathering talented, objective assistance to its use." It *was* a significant milestone, marking a turn in the hitherto rather distant relations between the Congress and the National Academy of Sciences. During much of the institution's history, the studies it did for the government were at the request of the Executive Branch. But since publication of *Basic Research and National Goals* in 1965, the Congress has ever more frequently mandated studies by the institution, either directing an agency to arrange for the study or, very rarely, by contracting with the Institution directly.

Indeed, while Congressional requests were -- and continue to be -- a small fraction of the institution's work, they are also among its most significant. Thus, in the 1970s, Congress asked the institution to examine the potential effects of increased carbon dioxide in the atmosphere, the effects of herbicide use in Vietnam, the biological effects of ionizing radiation, water quality, the effects of chlorofluorocarbons on the stratospheric ozone layer, and the risks and benefits associated with the use of saccharin.

That pattern continues. We have recently completed or are doing major studies requested by the Congress. Examples include health care for the homeless, a review of the international solar-polar mission, the quality of the data -- the error rates -- for the Aid For Families of Dependent Childred, Medicaid, and Food Stamp programs, an examination of the 55 mph speed limit, and the hazards to aviation posed by wind shear.

Of course, a list of studies only outlines the relationship between our institution and the Congress. We -- the three presidents, our members, the chairmen of our committees, staff, and others from our institution -- are called upon steadily to testify on matters involving science and technology and of interest to the Congress. We also, on occasion, provide briefings to Members of Congress and their staffs, especially on the Congressional import of reports of especial interest.

In short, we continue to have a lively dialogue. That dialogue contrasts vividly with the almost monopolistic use of our institution by the Executive Branch until the mid-sixties. That we have the dialogue is not simply recognition of a unique institution at the other end of Constitution Avenue. It expresses the centrality of science and technology to the nation's business and, hence, to the work of the Congress.

THE CONTEMPORARY INSTITUTION

I will move to outlining what we are involved in today, our structure, and our finances.

Reports

As always, reports continue to be our most visible product. Recent studies done or under way include:

- **Appraisals of the Strength and Progress of American Science**

  Surveys of chemistry, physics, mathematics, the social and behavioral sciences, basic biology, materials science and technology...the outlook for science and technology... future availability of scientific and engineering personnel ...engineering education and practice.

- **Examination of New Technologies**

  Plasma processing of materials...space station engineering and technology development...magnetic materials...marine biotechnology.

- **The Scientific Basis for the Regulatory Function of Government**

  Risk analysis and management...acid rain...meat and poultry inspection...vaccine supply and development...pollution in the Great Lakes Basin...the 55 mile per hour speed limit.

- **International Programs and Activities**

  Cooperative programs with developing countries...human rights...scientific exchanges with Eastern European countries. the Soviet Union, and the People's Republic of China...training Chinese scholars in the United States...encouraging the use of indigenous plants with economic potential.

- **Organization and Management of Technically Oriented Governmental Programs**

  Youth employment and training programs...immigration statistics...dredging coastal ports...improvements in the accuracy of census data...institutional arrangements for the space telescope...new directions for the biosciences in agriculture...navy information systems...priorities for major materials facilities...organization and structure of the National Institutes of Health...the Very High Speed Integrated Circuit program of the Department of Defense...military nutrition research.

- **Broad Aspects of Public Policy**

  Scientific freedom and national security...high schools and the changing workplace...mathematics education...sexual segregation in the workplace...a national strategy for basic and applied research on AIDS...nuclear power safety ...feeding the world's hungry...technology and employment.

Continuing Activities

Such reports are complemented by tasks that are continuing rather than discrete. Thus, we have committees to select the most qualified applicants for National Science Foundation fellowships and associateships at governmental agencies and national laboratories. We have committees that monitor our exchanges with the People's Republic of China and with the Eastern Bloc countries, including the Soviet Union. There are continual efforts to help developing countries apply science and technology effectively. We assist the states and local communities in improving their transportation systems, the construction industry in finding and using new materials and techniques, the National Bureau of Standards in calibrating the quality of its programs, and the Department of Energy in grappling with the interment of radioactive wastes.

New Approaches

We continue to experiment and to emplace new ways of serving the nation, of easing the translation of our analyses into public policy. Principal examples include the work over the past several years by the Committee on Science, Engineering, and Public Policy (COSEPUP) and the activities of the Government-University-Industry Research Roundtable.

Dr. White will discuss recent COSEPUP activities in his testimony. I will focus on the activities of the Roundtable.

The intentions for the Roundtable were to lubricate -- indeed, sometimes create -- conversations among senior officials of government, industry, and academe concerned with the health of the research enterprise. These intentions are being met. The Roundtable is slowly rubbing away the varnish of set positions, hostilities, suspicions, and unrealistic expectations that have marked past attempts to have the communities to talk to each other, openly and frankly.

This Task Force is aware of recent activities by the Roundtable. There is the demonstration in Florida to try out a new approach to grant administration in which the major research agencies of the government will use a common and simplified grant instrument and in which the universities can mirror those federal efficiencies with theirs, including a reduction in administrative layering. Also, the Roundtable is serving as a "neutral convenor" between the universities, administration and faculty, and the Office of Management and Budget, to see whether it is possible to resolve the current imbroglio over capping the major fraction of indirect costs.

Finally, the Roundtable organized a two-day conference at the Academy last February to consider the impact on research of the Gramm-Rudman-Hollings legislation. That conference served two purposes: to alert the research communities to the seriousness of the problem and to consider new strategies for the support of research.

In all, the Roundtable will continue to hew to its principal purpose: to provide a process or forum for dialogue and for generating options, rather than being a device for reaching specific conclusions and recommendations.

As the Chairman and this Task Force know well, this brief description only begins to sample what we are engaged in at the moment. Again, the documents provided with my testimony offer a fuller listing for the record. What is obvious is that we deal with matters of deep and continuing concern to this Task Force and, indeed, to the Congress. More subtly, the rationale for the institution endures: to be a midstation between American science and technology and the federal government, to be respected by both and beholden to neither, and to provide a home for competent and careful judgments on some of the most difficult issues of our time.

We are a unique institution. Foreign academies study us with the intention of emulating what we do. We continue to attract the *pro bono* services of the very best people in this country -- not only scientists, engineers, and physicians, but also lawyers, economists, political and educational leaders at every level of government, and senior executives of major corporations. That they continue to serve, to work extremely hard for no pay, is, I think, vivid evidence of the institution's strength.

Further evidence is our steady growth amid the arrival of other advisory mechanisms available to the Congress, notably the Office of Technology Assessment and the strengthened analytical capabilities of the Congressional Research Service. They are both very effective organizations, and their work is serving the Congress extremely well.

That the number of Congressional requests for studies by our institution has continued to grow mirrors the complexity of our world. Increasingly, there are matters not resolvable by straightforward analysis, but rather requiring the consentient judgments of the very best people this country has. They require settings in which the government's work is done, but with sufficient independence for careful and credible judgments and for exacting reviews. Increasingly, there are matters that require a vast spectrum of knowledge, often going beyond the capabilities of a single committee; requiring, rather, the broad and deep perspectives provided by the 9,000 volunteers who serve the National Research Council each year.

Finally, in an age when institutions are mistrusted, matters that are likely to divide the nation -- acid rain, diet and cancer, controls on scientific freedom, and much more -- must be judged in a setting that the American public believes can render judgments removed from the pressures normal to the political process. It is the role of our institution to provide such a setting.

Procedures and Review

I will outline how a report of the National Research Council gets done, and expand on that if there are questions. Studies originate principally through Administration or Congressional requests. Occasionally, we originate our own studies, funding them primarily with private or our own funds. Our work is done under sole source arrangements. We do not compete for contracts. All requests for studies must be approved by the Executive Committee of the Governing Board of the National Research Council or by the full Governing Board if the study is a particularly sensitive one because of policy implications or if it is classified. The studies are conducted by a committee of volunteers, paid for their expenses but not their time. A professional staff serves each committee.

Every committee report is subject to peer review, with the intensity of that review depending on the importance of the report. Put simply, the more distant a report is from pure technical analysis -- the nutritional requirements of domestic animals, for instance -- and the closer it is to judgments affecting policy -- the relation between diet and health, for example -- the greater the intensity of a full scale-review.

Such reviews are under the aegis of the Report Review Committee, composed solely of members of the two Academies and the Institute of Medicine. These reviews are serious business; reviewers put in enormous and anonymous time on them. By institutional requirement, committees must respond to each comment, and reports are redacted, invariably to their benefit. Thus, a recent and particularly sensitive report of the National Research Council elicited about 1,000 review comments, each of which was considered, incorporated, or received a reason for denial. At times, there are impasses, and I must make the final decision on the disposition of a report, as happened recently with the 10th edition of *Recommended Dietary Allowances*.

Let me note that we take our role as an "independent ally" of the government seriously. Indeed, it goes to the heart of our institution. Thus, we are not in business simply to be a critic of the government; other groups do that quite effectively. At the same time, we are firm in our insistence on independence. We are solely responsible for the composition of our committees. And the committees often ask that the charge be changed if they think it too narrow, too broad, too tendentious, or too superficial. Committee discussions are generally closed, to enable frank discussions. And no reports are released without committee and institutional approvals.

Once a report is approved -- by the committee, by the review body, and by me as Chairman of the National Research Council -- it is transmitted to the cognizant agency and printed by our National Academy Press. We average a report a day, with a significant number of them offered for sale. If warranted, a news release is distributed or a press conference held. For especially significant reports, we organize dinner symposia, held the evening prior to public release of a report. These symposia offer an opportunity to Members of Congress, senior governmental officials, and leaders from industry, the universities, and other sectors to hear the principal conclusions of a study from its committee members and to question them.

Finances

Ninety-nine million dollars is budgeted for our program activities for fiscal year 1986. About 86 percent of our program support comes from the federal government, and the remainder from nonfederal sources. The major sources of support, using FY1984-1985 figures, were the Department of Energy, the National Science Foundation, the Department of Defense, the National Aeronautics and Space Administration, and the Department of Health and Human Services.

Our nonfederal support has increased steadily since 1980, both absolutely and proportionately. In the 1980-1981 fiscal year, it was about $6 million and amounted to 8 percent of our total support. In the 1984-1985 fiscal year, it had risen to almost $12 million and represented 14 percent of our total support.

THE IMPACT OF THE INSTITUTION

Members of this Task Force will rightly regard the above as preamble to a basic question: What is the impact of what we do? Are our reports used? Are they effective?

These questions are at once simple and difficult. As you well know, the path between analysis and policy is rarely direct. It must march across contending constituencies and committees, elections, changes in Administration and in agency leadership, budget cuts, sudden shifts in political winds, and the like. Often, analyses -- especially purely technical ones -- may illuminate an issue but are not obvious in resultant laws and regulations. And, sometimes, studies are effective because an action was *not* taken.

Despite these caveats, one can deal most directly with questions about impact by looking at interactions between the Congress and our institution within the past year.

Our reports are indeed used. Our reports on the state of mathematics, chemistry, the need for new facilities for materials science, and on space-based oceanographic studies have all had a substantial impact on the FY 1987 budget proposed to the Congress by the Administration. Our recent report on population and economic growth was cited in the Congress as a "harbinger of a more balanced debate on international family planning and the role of the United States." Congressman Dingell praised the study of nursing homes by the Institute of Medicine as one that "has made us now optimistic about nursing home reform."

Debates in the Congress and in the Administration are informed by our recent work on issues such as the "nuclear winter" hypothesis, the links between academic research and national security controls, the problems of low-birth-weight babies, enhancing our international economic comeptitiveness, the complexities of the acid rain problem, the need for a coherent research program on highways, new technology transfer mechanisms, the future adequacy of scientific and engineering research personnel, science and mathematics education for elementary and high school students, and policies for an aging society.

Are our reports effective? That is answered, I think, by the recent legislative record. Thus, in 1985, studies by our institution have been requested on issues such as health care for the homeless, allied health professionals, error rates in welfare programs, and the establishment of a Council on Health Care Technology.

Appropriation actions traceable to our suggestions include increased support for astronomical sciences, recommendations that the National Institute of Mental Health increase its support of predoctoral researchers, the establishment of a center for injury control, and support for work on continental drilling and the international geosphere/biosphere programs.

Further, last year 43 individuals representing committees of the National Research Council and the Institute of Medicine testified before the Congress. Seventeen special briefings were held for Congressional staff and members, on topics as diverse as the Parkfield earthquake prediction, the toxicoligy information program, ecology and environmental problems, and medical technology. We provided advice to Congressional committees on Soviet space science, serious flaws in immigration statistics, the relation of epidemiology and air pollution, and other issues of concern.

There is more to be said on impact; but that, I think, should be left to this Task Force and to the Congress as a whole. I would only add that whatever frictions we may have on specifics, we ought to note the lively and necessary dialogues between our institutions: one dedicated to optimal use of the nation's scientific and technical resources and the other dedicated to illuminating the policy choices that must be made.

PROBLEMS AND OUTLOOK

Let me now offer some observations on the future course of our institution. As in the past, that will be shaped by various pressures, some beyond control. By now, the members of this Task Force are quite familiar with those pressures, but it may be helpful to highlight those that I believe to be major. Drs. White and Thier, in discussing engineering and health care, respectively, will amplify my listing.

First, we have a congeries of effects owing to secular limits on the growth of research support. These include:

- Greater pressures to set priorities among research fields. This can only be done with the participation of policymakers *after* a full briefing on the progress and opportunities in the cognizant fields through research briefings and other instruments.
- Ever more distressing evidence that our research structure is slipping into desuetude as facilities become obsolescent and instrumentation outdated. While the problem is acknowledged by the Congress and, in particular, in Chairman's Fuqua's efforts, remedies remain few and inadequate. The outlook is bleak.
- Steady erosion of the diversity of funding instruments and research locales that are two pillars of American science. We may see -- directly, through the use of institutional grants and, indirectly, through smaller grant sizes and shorter tenures -- further weakening of the investigator-initiated project grant -- the *sine qua non* of first-class research.
- More intensive efforts to internationalize "large science." The attractions are obvious, but the deeper implications must also be understood. Each proposal should be evaluated on a case-by-case basis.
- The allure of a research career may continue to dim, especially in biomedical research, where prospects for support and for faculty appointments are scant. Thus, graduate enrollment of science and engineering students is slowing. An increase of less than one percent is estimated by the National Science Foundation for 1985, compared to an average two percent increase from 1977 to 1983.

Second, we have the acknowledged relevance of science and technology to national goals, including improving our strength in the international economy and in national security. That epiphany will show up in various ways:

- Continuing efforts to put science to work, to boost the links between scientific and engineering research and industrial innovation. We are well started on that road already and, indeed, I think we now do it better than anyone else. At the same time, we need to spark even more relationships, especially in those fields that are essential to advanced technological competition and susceptible to fundamental inquiries. They include optoelectronics, especially the efforts to merge optical and electronic systems, magnetic and optical recording, and advanced materials, especially those exploiting the atom-by-atom layering techniques of surface science and the fabrication of electronic devices. Also, we will try even harder to use the abilities and resources of the federal laboratories, which may include closing some and enlarging others.

- An increasingly utilitarian view of basic research. Paraphrasing Orwell, we tend to believe that all basic research is good but that some is more useful than others. That is expressed in the budget proposed by the Administration, in which physical science and engineering received substantial boosts, but biomedical science was kept flat; in the recurring efforts to predict the commercial outcomes of basic research investments; and in the phrases such as "combined-mode research" and "strategic research" now pocking the science policy landscape. There is nothing wrong with that. The public pays for research, and can ask why it should. The danger is in creating an underclass of research, those fields whose utilitarian purposes are not immediately obvious and whose arguments for support are weakened accordingly. Yet, we know that basic research is serendipitous, and that often the greatest discoveries occur in fields quite remote from eventual application.

Third, I believe we may see -- or, better, *should* see -- changes in the interactions between science and government. This Task Force will have its own list, but I would emphasize the following:

- The communication between science and public policy needs to be improved. That the importance of science and technology to national welfare is now universally acknowledged does not lessen the frictions. The poor understanding of the mechanics of the relationship between science and the economy leads to dubious arguments, unmet expectations, and frustrations.

- The tensions of scientific freedom and national security need better resolution. Our strength is that we do research better than anyone else and, if we lose that superiority, then all of the rules, regulations, decrees, or national decision memoranda will not help.

- The Dickensian tangle of rules and regulations confronting the researcher seeking a grant needs cutting. Efforts to do so are under way in the Florida demonstration I referred to earlier. However, the process needs to be accelerated.

Keeping the above in mind, let me suggest some implications for the work of our institution, especially the National Research Council:

- The rate of Congressional requests to the institution may continue to rise, as will their inherent difficulties. As I have mentioned, the relation between science and the economy is complex, there are ever greater pressures to use limited resources more effectively, and the Congress, and the Administration, must find some transposable way of choosing budgetary priorities among scientific and engineering research fields.

- The institution will continue to be pressured to balance the need for rapid studies against the need to obtain funds, negotiate contracts with agencies, form ad hoc committees of volunteers, and the like.

- The budgetary pressures may affect our volunteer system as the exigencies of maintaining research support at a home base reduce the time available for public service.

- Our resources for conducting independent studies -- initiated and supported without governmental involvement -- will continue to be constrained. While we have acquired more funds from the private sector for such studies in recent years, the greater competition for private sources of funds may begin to reduce our capacities to do those studies which we feel are essential but which federal agencies, for various reasons, do not.

Mr. Chairman and members of this Task Force, this completes my testimony. I hope it is not immodest for me to assert that the National Research Council is perhaps the most powerful technical advisory apparatus available to any government in the world. That this is so is not just a tribute to the scientific and technological community; it is a tribute to a government that understands that the world is not simple, that to govern means to choose wisely, and that one can only do that by understanding. It is the role of our institution to assist in that understanding, and to inform the difficult choices which must be made. We will continue to do that, whenever called upon.

Thank you.

* * *

Mr. FUQUA. Dr. White.

[A biographical sketch of Dr. White follows:]

DR. ROBERT M. WHITE

Dr. Robert M. White, President of the National Academy of Engineering, was born in Boston, Massachusetts in 1923 and took his university degrees at Harvard and MIT. His undergraduate work at Harvard was in geology and his graduate work at MIT, after a four-year stint in the Army Air Corps during World War II, was in geophysical fluid dynamics, applied to the atmosphere. He left MIT in 1950 for a highly productive decade in research on problems of atmospheric prediction and global atmospheric and ocean dynamics at the Air Force Cambridge Research Center.

NAE's President is recognized not only as a significant contributor to his field of science and technology, but also as an institutional innovator. He was a co-founder of the Travelers Research Center, Inc., a non-profit subsidiary of the Travelers Insurance Company in Hartford, Connecticut, in 1959. It was one of the first corporations in the private sector to embark on a program of research and services in the environmental sciences. The corporation served private industry, federal, and state governments. At Travelers, Dr. White led a major effort for the FAA in the design and development of automated systems for observing, communicating and forecasting weather.

His work at Travelers led to his appointment by President John F. Kennedy as Chief of the U.S. Weather Bureau in 1963. Over the next 15 years, Dr. White was appointed to a succession of Presidential posts of increasingly greater responsibility. He served under five Presidents, (Kennedy, Johnson, Nixon, Ford, and Carter) in important governmental posts. These years led to his involvement and interest in a wide range of science and technology policy issues. Under Presidents Kennedy and Johnson, he undertook the restructuring of the Weather Bureau and fostered the introduction on new technologies of weather observation, communications, and processing. He led the Weather Bureau in the establishment of the first operational earth orbiting meterological satellites. Today these satellites are the backbone of the global meteorological observation system. He fostered the introduction of new technologies of high speed communications and display systems to improve the responsiveness of the daily operations of the whether service. He was a leader in the institutional restructuring of environmental sciences and services in government. In 1965, Dr. White and others convinced President Lyndon Johnson to bring together the Weather Bureau, the Coast and Geodetic Survey and part of the National Bureau of Standards into a new Environmental Sciences and Services Administration.

In 1968, he was appointed to the President's Commission on Marine Science, Engineering, and Resources chaired by Dr. Julius A. Stratton, then President of MIT. This Commission led to the formation of the National Oceanic and Atmospheric Administration (NOAA) under President Nixon. Dr. White was appointed its first Administrator. NOAA was to be the center strength in the federal government for oceanic and atmospheric affairs. It brought together activities as diverse as the Bureau of Commercial Fisheries, the National Sea Grant Program, Naval Oceanographic Instrumentation Center, the Coast and Geodetic Survey, and the U.S. Weather Bureau. The task of welding these diverse elements into the formidable agency it has since become, was successfully completed under his leadership.

In the early 1970's the Congress enacted an extensive body of new environmental legislation and broadened NOAA's responsibilities to include the administration of The Fishery Conservation and Management Act of 1976 and the Coastal Zone Management Act, Marine Mammal Protection Act, and the Marine Sanctuaries Act, thus confronting the new agency with difficult policy issues of balancing environmental values and economic development. As part of these new responsibilities, Dr. White was appointed the U.S. Commissioner to the International Whaling Commission, and there led the fight to protect the great whales.

For NOAA and its predecessor organizations, international collaboration was a way of life and Dr. White was involved in many of them. He was the Permanent Representative of the United States to the World Meteorological Organization of the United Nations for 15 years. He was a key figure in the development of the World Weather Watch and Global Atmospheric Research Programs which saw the deployment of new satellite and communications technology on a worldwide basis. He was the chief negotiator for the United States in the development of bilateral agreements, for example, with the Soviet Union under President Nixon for the exploration of the world's oceans, and with France on oceanography. He stimulated the development of the FAMOUS Program (French American Mid Ocean Undersea Survey) in which manned civil submersibles from the United States and France descended 12,000 ft. to explore the Mid Atlantic Ridge.

Upon leaving the government in 1977, Dr. White joined the National Research Council and in 1979 became its Administrator. On a part-time basis he was asked by the oceanographic institutions of the United States to organize a new university consortium called the Joint Oceanographic Institutions, Inc. to plan and oversee the nation's deep sea drilling program carried out aboard the *Glomar Challenger.* As Administrator of the National Research Council, Dr. White was instrumental in leading the effort to establish the new National Academy Press as a means of improving the publication system of the Council.

In 1980, he assumed the presidency of the University Corporation for Atmospheric Research (UCAR), a consortium of 50 U.S. and Canadian universities which operates the National Center for Atmospheric Research (NCAR) in Boulder, Colorado and the National Scientific Balloon Facility in Palestine, Texas. At the same time, he was appointed Chairman of the Commission on Natural Resources overseeing a wide range of the NRC's activities in the field of energy, agriculture, minerals and the environment, and subsequently, Co-Chairman of the Commission on Physical Sciences, Mathematics and Resources.

Dr. White continues to be active in an advisory capacity to the United States Government. He is a member of the Advisory Committee on Science and Technology to the Department of State and until recently, was a member of the National Advisory Committee on Oceans and Atmosphere (NACOA), a Presidential Commission with oversight of oceanic and atmospheric affairs in the U.S. government.

He has retained an active role in academic affairs. He has had extensive involvement with the university community as President of UCAR. He has been a member of the Board of Overseers of Harvard University Visiting Committee to the Division of Applied Sciences.

Dr. White is a member of the Board of Directors of Resources for the Future, Inc. in Washington, D.C., the Draper Laboratories in Cambridge, Massachusetts, and is a member of the Council on Foreign Relations, New York, New York.

Dr. White has been honored for his scientific work as well as his other contributions. He was elected to the National Academy of Engineering in 1968. He was made the recipient of the Jesse L. Rosenberger Medal of the University of Chicago in 1971, the Rockefeller Public Service Award for Natural Resources in 1974, the Matthew Fontaine Maury Award for Contribution to Undersea Exploration of the Smithsonian Institution in 1976, and the International Conservation Award of the U.S. Wildlife Federation in 1977. Dr. White was also the recipient of the prestigious International Meterological Organization Prize of the World Meteorological Organization in 1980. In 1984, he was awarded the Delmer S. Fahrney Medal by the Franklin Institute for outstanding leadership in science and technology. He is a Chevalier de las Legion d'Honneur of France. His work has been recognized by honorary doctorates from Johns Hopkins University, the University of Wisconsin in Milwaukee, Rensselaer Polytechnic Institute, and Long Island University. He has been President of the American Meteorological Society and Vice President of the Marine Technology Society.

Dr. White lives in Bethesda, Maryland with his wife, Mavis. He has two children. His son Richard is an economist in Washington, D.C. and his daughter Edwina a business executive living in Manhattan.

STATEMENT OF DR. ROBERT M. WHITE, PRESIDENT, NATIONAL ACADEMY OF ENGINEERING, WASHINGTON, DC

Dr. WHITE. Mr. Chairman, and members of the Science Policy Task Force, I welcome this opportunity to appear before you to discuss the advisory functions of the National Academy of Engineering. I would like to take this opportunity to congratulate you, Mr. Chairman, and members of the task force, for undertaking this important review. It is timely because of the challenges to U.S. technological leadership, and the broad economic implications of loss of that leadership.

As Dr. Press told you, the Academies of Sciences and Engineering, together with the Institute of Medicine, oversee the activities of the National Research Council, where the bulk of the work of advising the Government takes place. These advisory functions are carried out principally in response to requests from Federal agencies or from the Congress for assessments and evaluations on problems of national importance involving science and technology.

The academy complex is working well, and its separate elements operate together as an effective team capable of assembling the Nation's leading authorities on any topic across the full spectrum of science, engineering and medicine. Dr. Press informed you of the magnitude of the work undertaken by this team. It is large and complex. We believe that we are successfully fulfilling the aims of the charter granted in 1863 by the Congress.

Although the NAS is over a century old, other elements of the academy structure are newer. The National Academy of Engineering was founded 22 years ago in 1964. At that time, it was evident that the problems of engineering and technology were moving to the front of national concern. The post—World War II technological and industrial dominance of the United States was coming to an end, and the country faced serious problems of international industrial competition. We now live with those problems, and they have become increasingly troublesome as they affect jobs and standards of living. The problems we face pertain not only to mature industries, such as steel, and textiles, and automobiles, but semiconductors, pharmaceuticals and biotechnology.

The National Academy of Engineering was formed to reflect the expanded role of engineering and technology in our national life and to enable the academy complex to better advise the Federal Government. The current challenge of America's technological leadership is the principal focus of the work of the National Academy of Engineering. We have formulated and are now implementing our technological leadership program, a decade-long effort to advance the industrial competitiveness, the economic growth, and general welfare of the United States. A description of this activity is contained in the report accompanying this testimony. President Reagan has strongly endorsed the technological leadership program and encouraged the academy to pursue its work as one means of ensuring American technological leadership into the 21st century.

The National Academy of Engineering accomplishes its objectives through several means: jointly with the National Academy of Sciences; through the National Research Council, through the Committee on Science, Engineering and Public Policy; and also independently. The academies, the National Research Council, and Committee on Science, Engineering and Public Policy have conducted numerous studies related to engineering and technology. Dr. Press has provided such material for the record.

Undergirding the ability of the national academies to provide objective and credible advice are their distinguished memberships. In the case of the National Academy of Engineering, the membership consists of engineering and technology leaders from both the industrial sector and the university community. As Dr. Press has indicated, we call not only upon our members for the participation in studies, but also upon the entire scientific and technical community throughout the country.

The industrial and economic challenges facing the United States in an increasingly integrated global economy are manifold. Whereas macroeconomic conditions are a basic determinant of the competitiveness of our industry, and macroeconomic policies shape key aspects of the competitive struggle, it is our technological leadership, based on a vigorous scientific and engineering enterprise, that is the sine qua non for remaining competitive in the long term.

The national academies serve as an important national institution to advise on many critical public issues involving science and technology. For example:

What will be the effect of technological change on employment and job creation?

How do we rationalize national policy to ensure trade in high-technology products while protecting our national security?

What are the relationships between economic policies and technological innovation?

How do we capture the benefits of the enormous U.S. investment in basic scientific and engineering research and its attendant discoveries that contribute to the world pool of knowledge?

How do we change our educational system to ensure the production of knowledgeable, adaptable, technologically literate citizens who can manage and operate our industrial and governmental institutions in the economy of future?

What is the nature of engineering education and practice in this country, and is it attuned to our national needs?

How can we improve allocation of Government resources to priority areas of research and development that can lay a firm basis for new industry?

What is the relative status of critical technologies in the United States and among our industrial trading partners and competitors?

These are the types of issues now being addressed by the national academies, the National Research Council, and Committee on Science, Engineering and Public Policy. In fact, the work of the national academies on industrial competitiveness is an excellent example of how the institution can focus on the capabilities of its separate parts on a many faceted national issue of formidable proportions. It also demonstrates how the institution uses both public and private funds to support a multipronged effort.

The Committee on Science, Engineering and Public Policy, for example, is now examining two major issues related to industrial competitiveness. First is its study on technology and employment. Of all the issues the Nation must grapple with, that of job creation and job loss must be among the most pressing. The problem is driven by two independent forces of change: automation resulting from investments in new technology; and the movement of jobs overseas as production in many industries moves offshore.

Second, the Committee on Science, Engineering and Public Policy is addressing the impact of export control laws and regulations on trade in high-technology products. Achieving a balance between our national security interests in relation to technology transfer, and the vitality of our science and engineering and the health of our economy as they benefit from international trade is a sensitive and difficult issue. These comprehensive studies are supported by funds raised preponderantly in the private sector.

New Committee on Science, Engineering and Public Policy study areas include a fifth "Outlook for Science and Technology" whose principal audience is the Congress, and a study of the impact of information technologies on research. The Committee on Science, Engineering and Public Policy also interacts directly with the Office of Science and Technology Policy in the White House, and with policy officials of other agencies through its annual briefings on science and technology issues. These briefings are short analyses of major research opportunities in particular fields of science and technology; 32 topics will have been covered with completion of the current round, scheduled for delivery in June. Recent briefing topics include computer architecture, remote sensing of the Earth, atherosclerosis, information technology in precollege education, computer vision and pattern recognition, and the science of interfaces and thin films.

To better understand the competitive position of the U.S. industrial sector, the National Academy of Engineering has conducted an extensive series of studies on the competitiveness of seven industries, namely textiles, machine tools, steel, pharmaceuticals, automobiles, electronics, and aircraft. Each industry has a different set of problems and depends on new technology in a different way to advance its competitive position. But one thing all industries have in common is that each is now part of a globally integrated industrial and economic activity.

The National Academy of Engineering has also undertaken studies of the effects of our American economic policies on technological innovation and has conducted symposia looking into the problem of harnessing technology for economic growth.

If the macroeconomic environment can be favorable to trade and investment in new technology, then in the long run our technological leadership and the associated industrial competitiveness will depend on the ability of our educational system to produce technologically literate citizens of all walks of life. In addition, our education system must be able to produce scientists and engineers capable of advancing the cutting edge of knowledge.

Several major new studies and novel efforts are underway in the National Research Council to address these problems. For example, a new multivolume analysis of "Engineering Education and Practice in the United States" assesses what we can do to ensure a continuing vigorous national engineering enterprise. This is vital, for it is in the translation of discoveries from basic research to commercial products that we are being bested by our trading partners and competitors abroad.

A companion study, soon to be released, sets out priorities for Federal Government support of engineering research, which over the long term will help advance our industrial competitiveness. In response to a request from the National Science Foundation, the National Research Council has begun a series of studies to assess technological developments in other countries and to ascertain their relative strengths and competitiveness in rapidly evolving areas of science and technology. One such study highlights Japan's rapid advances in the development of equipment for fabrication of electronic materials such as microchips. In this area, the United

States has held a strong lead and still retains a preponderant market share, but we are being severely challenged.

The national academies are seeking to build and foster new mechanisms and institutions for addressing important technological issues. Let me give you some examples. National Academy of Engineering advice played a significant role in establishment of the Engineering Research Center Program of the National Science Foundation, an innovative approach to engineering research on campuses. These multidisciplinary research centers will carry out research related to important industrial needs. They will seek to bring universities and industries together as partners in the process.

On another front, the national academies, working through their foreign associates, have established a nongovernmental channel for discussion of technology and trade issues among technological leaders of the United States and Japan.

The national academies are now considering, at the request of OSTP and National Science Foundation, the establishment of a manufacturing forum where governmental, industrial, and university leaders can discuss issues related to manufacturing, an activity in which we are rapidly losing ground to our foreign competitors.

The breadth of the national academies' work on industrial competitiveness and the complex problems affecting the economic welfare of the United States illustrates the unique strength the national academies contribute to examination of major national problems, related to science and technology. The diverse capabilities of the several parts of the institution are its strengths.

Let me close by reiterating that the review by this task force is of fundamental importance in setting the policy framework for the future conduct of scientific and engineering research in the United States. No undertaking is more important if this country is to maintain its technological leadership. Members of the National Academy of Engineering are therefore reviewing the nature of the Federal Government support for engineering research and education so that we can be in the position to inform the task force of our thinking. At an appropriate time, I would be pleased to appear before you to present the academy's views on these matters, or to provide them to you in writing.

Thank you.

[The prepared statement by Dr. White follows:]

TESTIMONY OF

Dr. Robert M. White
President
National Academy of Engineering

for delivery before the

Committee on Science and Technology
Science Policy Task Force
U.S. House of Representatives

May 8, 1986

Mr. Chairman and members of the Science Policy Task Force, I welcome this opportunity to appear before you to discuss the advisory functions of the National Academy of Engineering (NAE). I would like to take this opportunity to congratulate you Mr. Chairman, and members of the Task Force, for undertaking this important review. It is timely because of the challenges to U.S. technological leadership, and the broad economic implications of loss of that leadership.

As Dr. Press has told you, the Academies of Sciences and Engineering, together with the Institute of Medicine, oversee the activities of the National Research Council (NRC) where the bulk of the work of advising the government takes place. These advisory functions are carried out principally in response to requests from federal agencies or from the Congress for assessments and evaluations on problems of national importance involving science and technology.

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The NAE was formed to reflect the expanded role of engineering and technology in our national life and to enable the Academy complex to better advise the federal government. The current challenge to America's technological leadership is the principal focus of the work of the NAE. We have formulated and are now implementing our Technological Leadership Program, a decade-long effort to advance the industrial competitiveness, the economic growth, and general welfare of the United States. A description of this activity is contained in the report accompanying this testimony. President Reagan has strongly endorsed this Technological Leadership Program and encouraged the Academy to pursue its work as one means of ensuring American technological leadership into the 21st century.

The National Academy of Engineering accomplishes its objectives through several means: jointly with the NAS; through the NRC; through the Committee on Science, Engineering, and Public Policy (COSEPUP); and also independently. The Academies, the NRC, and COSEPUP have conducted numerous studies related to engineering and technology. Dr. Press has provided such material for the record.

Undergirding the ability of the Academies to provide objective and credible advice are their distinguished memberships. In the case of the National Academy of Engineering, the membership consists of engineering and technology leaders from both the industrial sector and the university community. As Dr. Press has indicated, we call not only upon our members for participation in studies, but also upon the entire scientific and technical community throughout the country.

The industrial and economic challenges facing the United States in an increasingly integrated global economy are manifold. Whereas macroeconomic conditions are a basic determinant of the competitiveness of our industry, and macroeconomic policies shape key aspects of the competitive struggle, it is our technological leadership, based on a vigorous scientific and engineering enterprise, that is the sine qua non for remaining competitive in the long term.

The Academies serve as an important national institution to advise on many critical public issues involving science and technology. For example:

- What will be the effect of technological change on employment and job creation?
- How do we rationalize national policy to ensure trade in high-technology products while protecting our national security?
- What are the relationships between economic policies and technological innovation?
- How do we capture the benefits of the enormous U.S. investment in basic scientific and engineering research and its attendant discoveries that contribute to the world pool of knowledge?

- How do we change our educational system to ensure the production of knowledgeable, adaptable, technologically literate citizens who can manage and operate our industrial and governmental institutions in the economy of the future?
- What is the nature of engineering education and practice in this country, and is it attuned to our national needs?
- How can we improve allocation of government resources to priority areas of research and development that can lay a firm basis for new industry?
- What is the relative status of critical technologies in the United States and among our industrial trading partners and competitors?

These are the types of issues now being addressed by the Academies, the NRC, and COSEPUP. In fact, the work of the Academies on industrial competitiveness is an excellent example of how the institution can focus the capabilities of its separate parts on a many-faceted national issue of formidable proportions. It also demonstrates how the institution uses both public and private funds to support a multipronged effort.

COSEPUP, for example, is now examining two major issues related to industrial competitiveness. First is its study on technology and employment. Of all the issues the nation must grapple with, that of job creation and job loss must be among the most pressing. The problem is driven by two independent forces for change: automation resulting from investments in new technology; and the movement of jobs overseas as production in many industries moves offshore.

Second, COSEPUP is addressing the impact of export control laws and regulations on trade in high-technology products. Achieving a balance between our national security interests in relation to technology transfer, and the vitality of our science and engineering and the health of our economy as they benefit from international trade is a sensitive and difficult issue. These comprehensive studies are supported by funds raised preponderantly in the private sector.

New COSEPUP study areas include a fifth Outlook for Science and Technology, whose principal audience is the Congress, and a study of the impact of information technologies on research. COSEPUP also interacts directly with the Office of Science and Technology Policy in the White House and with policy officials of other agencies through its annual briefings on science and technology issues. These briefings are short analyses of major research opportunities in particular fields of science and technology. Thirty two topics will have been covered with completion of the current round, scheduled for delivery in June. Recent briefing topics include computer architecture, remote sensing of the earth, atherosclerosis, information technology in precollege education, computer vision and pattern recognition, and the science of interfaces and thin films.

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The NAE has also undertaken studies of the effects of our American economic policies on technological innovation and has conducted symposia looking into the problem of harnessing technology for economic growth.

If the macroeconomic environment can be favorable to trade and investment in new technology, then in the long run our technological leadership and the associated industrial competitiveness will depend on the ability of our educational system to produce technologically literate citizens of all walks of life. In addition, our educational system must be able to produce scientists and engineers capable of advancing the cutting edge of knowledge.

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The Academies are seeking to build and foster new mechanisms and institutions for addressing important technological issues. Let me give you some examples. NAE advice played a significant role in establishment of the Engineering Research Center program of the National Science Foundation, an innovative approach to engineering research on campuses. These multidisciplinary research centers will carry out research related to important industrial needs. They will seek to bring universities and industries together as partners in the process.

On another front, the Academies working through their foreign associates have established a nongovernmental channel for discussion of technology and trade issues among technological leaders of the United States and Japan.

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The breadth of the Academies' work on industrial competitiveness and the complex problems affecting the economic welfare of the United States illustrates the unique strength the Academies contribute to examination of major national problems related to science and technology. The diverse capabilities of the several parts of the institution are its strengths.

Let me close by reiterating that the review by this Task Force is of fundamental importance in setting the policy framework for the future conduct of scientific and engineering research in the United States. No undertaking is more important if this country is to maintain its technological leadership. Members of the National Academy of Engineering are therefore reviewing the nature of federal government support for engineering research and education so that we can be in a position to inform the Task Force of our thinking. At an appropriate time, I would be pleased to appear before you to present the Academy's views on these matters, or to provide them to you in writing. Thank you.

Mr. FUQUA. Thank you very much Dr. White.

Now we will hear from Dr. Thier.

[A biographical sketch of Dr. Thier follows:]

SAMUEL O. THIER, M.D.

Samuel O. Thier, M.D., is President of the Institute of Medicine, National Academy of Sciences. He is immediate past Sterling Professor and Chairman of the Department of Internal Medicine, Yale University School of Medicine. He was also a member of the Department's Renal Section.

Dr. Thier received his undergraduate education at Cornell University and his M.D. from the State University of New York at Syracuse in 1960. Following his postgraduate training at Massachusetts General Hospital, including a year as Chief Resident in Medicine, he held an appointment as Chief of the Renal Unit and Assistant Professor of Medicine at Harvard. He then served as Vice Chairman and Professor of Medicine at the University of Pennsylvania School of Medicine prior to his appointment as Professor and Chairmán of the Department of Internal Medicine at Yale. Dr. Thier was the Chairman of the Executive Committee of the Yale University Faculty Practice Plan, and a member of the Board of Trustees of the Yale-New Haven Hospital.

Dr. Thier has received numerous awards, honors, and memberships in honorary societies. He has served as President of the American Federation of Clinical Research, Regent, American College of Physicians, and Chairman, American Board of Internal Medicine. Dr. Thier did research at the National Institutes of Health from 1962-64 and from 1980-84 served on the Director's Advisory Committee, National Institutes of Health. He has authored numerous articles on renal physiology, with a particular interest in inherited disease of kidney, and kidney stones, and has co-authored with his colleague Lloyd H. Smith, Jr., M.D. a text book of pathophysiology.

Dr. Thier and his wife Paula have three children.

STATEMENT OF DR. SAMUEL O. THIER, PRESIDENT, INSTITUTE OF MEDICINE, WASHINGTON, DC

Dr. THIER. I, too, welcome the opportunity to discuss with you the role and activities of the Institute of Medicine.

The Institute of Medicine is the youngest member of the national academies complex. Dr. Press has described the position of the institute within the complex, but I would emphasize a few points.

The Institute of Medicine was founded under the charter of the National Academy of Sciences in 1970. It is primarily concerned with the issues of science, quality, organization, and financing that affect the health of the public. From the outset, the membership of the Institute of Medicine was designed by charter to bring broad perspective to its deliberations. At least one-quarter of the members must be in nonhealth fields, such as physical and engineering sciences, ethics, economics, journalism, and law. They are elected because of their contributions to health. The three-quarters of the members who are in the field of health include basic biological and social scientists, physicians, nurses, dentists, allied health personnel, and medical administrators. Both academic and practice perspectives are represented. In accepting election to the Institute of Medicine, members agree to participate without compensation in the studies conducted by the Institute. Of course, the Institute calls upon whatever outside expertise is necessary to conduct a study, but on the average, 50 percent of the participants in our studies are Institute of Medicine members. The Institute initiates and conducts its own studies, but they must be approved by the governing board of the National Research Council, and the study reports are reviewed by the Report Review Committee of the National Research Council. This oversight of all academy study activities by the NRC helps in maintaining quality and in providing the necessary coordination among the various components of the academy, which have many interests in common. The Institute receives about 70 percent of its funding from the Government and 30 percent from the private sector. This somewhat higher proportion of private funding permits us greater program flexibility and improves the timeliness with which we can respond. I would like to focus now on: one, changes in the Institute of Medicine structure and its spectrum of responses to requests for advice; two, the timeliness; and three, the impact of that advice.

The Institute of Medicine is governed by a council that has just recently been reorganized to expand the time it commits to issues. The council oversees the Institute's program, the dissemination of its advice, and its development activities, as well as monitoring financial and membership activities. The Program Committee, the heart of the Institute's activities, is chaired by the member of the council and includes the Chair of each of the Institute's five advisory boards as well as additional broad membership representation. The program is developed in consolidation with members of the executive and legislative branches of Government, local health officials, representatives of the private sector, and the membership of the Institute. The program provides a framework by which requests for advice from the Government can be placed in suitable context. Then the Institute can draw effectively on its previous studies, coordinate its present activities, and project needs for future program initiation.

The timeliness of the advice offered by the Institute will be enhanced by several additions to our portfolio of responses. First, we are increasing our activities as a broker of sound, current information and judgment. That is, we identify a balanced group of members who are expert in a specific issue. Their conclusions are provided as individuals but their background, expertise, and spectrum of views are attested to by the Institute. We have used this mechanism in providing advice to the Food and Drug Administration, prior to the Nairobi Conference on Drugs in the Developing Countries and the recent tragic episode on tampering with Tylenol. This type of advice can be made available in as little as 1 week's time.

Second, we are expanding our function as a convener of experts with a broad array of interests. In conference, such groups can lay out the issues, the tensions, and the options posed by a given problem but need not reach a consensus. What they should produce is a better informed political process. We recently used this mechanism in responding to a request from Chairmen Dingell and Hatch to consider further issues in vaccine development, a matter in which we have a longstanding interest. In a few weeks, we were able to convene about 60 foundations, and congressional staff to spend 2 days discussing the issues inherent in developing an oversight and coordination of vaccine production for this country and for developing countries. No consensus was attempted, but I am convinced that the congressional staff was provided with many important insights with which to shape the next steps in the political process. This process was again facilitated by access to flexible funding.

Third, we conduct our traditional committee studies as we are doing in examining the future of public health, and as we recently did in looking at means of improving the quality of nursing home care. These studies may take 18 months to 2 years, deal with complex issues, and—as happened with the nursing home study, can be readily translated into policy. We also can use our committee mechanism for more rapid deliberation, as is now underway in our study of AIDS. We are conducting a 6-month study of the national strategies for dealing with AIDS research and clinical care. This study is being conducted with independent funds of the National Research Council at the initiative of the councils of the National Academy of Sciences and Institute of Medicine. The study illustrates our ability to act in a more rapid fashion on critical issues, as well as the importance of being able to set our own agenda when flexible, independent funding is available. Our advice was not specifically requested on this issue, but it was felt by the Academy and the Institute to be essential. It is within our charter responsibility not only to respond to requests for advice, but to identify critical issues and offer advice even if not requested.

Fourth, we are exploring a new mechanism for providing advice, that of establishing a standing council to deal in a continuing fashion with issues that are not episodic but rather are perpetual. Our Health Technology Assessment Council is such a model. Only a decade ago, the coordination of health technology assessment was a function located exclusively in the Department of Health and Human Services. It failed for lack of support from many of the people it was intended to serve—the health-care providers and technology manufacturers. Now, created by Federal statute, the new Council on Health Care Technology at the Institute of Medicine is a private-sector body, offering a neutral setting that is attracting broad acceptance and willing participation from those who were most critical of the former Government effort. This version of a standing council also provides an interesting funding mechanism. Federal support in the form of matching dollars was able to stimulate funding from the private sector. The result is a joint private-public activity which is at the moment adequately funded. Another example of a persistent set of problems that require continuing discussion is drug development and regulation and we are in the process of forming a separate council for those issues. It is my plan to form a critically needed third council which will concentrate on the issues of quality, access, and financing of health care.

It is difficult to measure the impact of our advice on policy, but it is worth noting that our recent report on quality of care in nursing homes has already been cited as the basis for new legislation, that our studies of personnel needs and training of biomedical and behavioral research personnel have been the basis for training grant support, that our study on preventing low birthweight has been translated into legislative initiative, that our study report on research opportunities in alcoholism furnished such a valuable guide to the National Institute on Alcohol Abuse and Alcoholism that they have asked us to conduct it again, and that our studies on vaccine development have been the basis for much activity in Congress. In fact, the Health Technology Assessment Council, which I discussed, was established by Congress in response to an Institute of Medicine report. For those not fully acquainted with Institute of Medicine's breadth of interests, I have an outline of our program themes with past, present, and projected future activities which I would like to enter into the record.

Ensuring that the advice of the Institute, ranging across the entire health enterprise, is translated into policy is a complex issue. The support of basic biomedical research is predominately a Federal Government activity, but the organization and delivery of health care and its financing are greatly decentralized and have important regional, State, and local components. We are exploring ways of improving the impact of our reports. We are attempting to develop a clear strategy for dissemination to appropriate target groups before we initiate a study. The question of dissemination is one not only of target groups but of mechanism. We are considering expanding from our traditional detailed reports into brief summary documents, books for use by the public, video tapes for teaching in colleges and high schools, and even new meeting formats for enhancing the linkage between scientists and policymakers.

These comments have necessarily been brief, but I hope they have illustrated the commitment of the Institute of Medicine to maintain the quality of its deliberations while enhancing the timeliness of its advice. We are trying to provide that advice in the most usable form to as many components of our society as required to translate it into policy. We recognize that the Government is faced with the apparent paradox of having great scientific opportunities for benefiting mankind while potentially having to limit access to those benefits. To make these and other most difficult choices, you will require the most thoughtful, expert, and timely advice possible. Providing that advice is our reason for being, and we will continue to explore strategies, organizational changes, and financing mechanisms to perform our job more effectively.

Thank you.

[The prepared statement of Dr. Thier follows:]

TESTIMONY

BY

SAMUEL O. THIER, M.D.

PRESIDENT

INSTITUTE OF MEDICINE

NATIONAL ACADEMY OF SCIENCES

TO THE

TASK FORCE ON SCIENCE POLICY

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MAY 8, 1986

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The Institute of Medicine was founded under the Charter of the National Academy of Sciences in 1970. It is primarily concerned with issues of science, quality, organization, and financing that affect the health of the public. From the outset the membership of the Institute of Medicine was designed by Charter to bring broad perspective to its deliberations. At least one-quarter of the members must be in non-health fields, such as physical and engineering sciences, ethics, economics, journalism, and law. They are elected because of their contributions to health. The three-quarters of members who are in the field of health include basic biological and social scientists, physicians, nurses, dentists, allied health personnel, and medical administrators. Both academic and practice perspectives are represented. In accepting election to the Institute of Medicine, members agree to participate without compensation in the studies conducted by the Institute. Of course, the Institute calls upon whatever outside expertise is necessary to conduct a study, but, on the average, 50 percent of the participants in our studies are IOM members. The Institute initiates and conducts its own studies, but they must be approved by the Governing Board of the NRC, and the study reports are reviewed by the Report Review Committee of the NRC. This oversight of all Academy study activities by the NRC helps in maintaining quality and in providing the necessary coordination among the various components of the Academy, which have many interests in common. The Institute receives about 70 percent of its funding from the government and 30 percent from the private sector. This somewhat higher proportion of private funding permits us greater program flexibility and improves the timeliness with which we can respond. I would like to focus now on 1) changes in the IOM structure and its spectrum of responses to requests for advice, 2) the timeliness, and 3) the impact of that advice.

The Institute of Medicine is governed by a Council that has just recently been reorganized to expand the time it commits to issues. The Council oversees the Institute's program, the dissemination of its advice, and its development activities, as well as monitoring financial and membership activities. The Program Committee, the heart of the Institute's activities, is chaired by a member of the Council and includes the chair of each of the Institute's five advisory boards as well as additional broad membership representation. The program is developed in consultation with members of the executive and legislative branches of government, local health officials, representatives of the private sector, and the membership of the Institute. The program provides a framework by which requests for advice from the government can be placed in suitable context. Then the Institute can draw effectively on its previous studies, coordinate its present activities, and project needs for future program initiation.

The timeliness of the advice offered by the Institute will be enhanced by several additions to our portfolio of responses. First, we are increasing our activities as a broker of sound, current information and judgment. That is, we identify a balanced group of members who are expert in a specific issue. Their conclusions are provided as individuals but their background, expertise, and spectrum of views are attested to by the Institute. We have used this mechanism in providing advice to the Food and Drug Administration prior to the Nairobi Conference on Drugs in the Developing Countries and the recent tragic episode on tampering with Tylenol. This type of advice can be made available in as little as one week's time.

Second, we are expanding our function as a convener of experts with a broad array of interests. In conference such groups can lay out the issues, the tensions, and the options posed by a given problem but need not reach a consensus. What they should produce is a better informed political process. We recently used this mechanism in responding to a request from Chairmen Dingell and Hatch to consider further issues in vaccine development, a matter in which we have a long-standing interest. In a few weeks we were able to convene about 60 members of academe, industry, government research agencies, foundations, and congressional staff to spend two days discussing the issues inherent in developing an oversight and coordination of vaccine production for this country and for developing countries. No consensus was attempted, but I am convinced that the congressional staff was provided with many important insights with which to shape the next steps in the political process. This process was again facilitated by access to flexible funding.

Third, we conduct our traditional committee studies as we are doing in examining the future of public health, and as we recently did in looking at means of improving the quality of nursing home care. These studies may take 18 months to two years, deal with complex issues, and--as happened with with the nursing home study--can be readily translated into policy. We also can use our committee mechanism for more rapid deliberation, as is now under way in our study of AIDS. We are conducting a six-month study of the national strategies for dealing with AIDS research and clinical care. This study is being conducted with independent funds of the National Research Council at the initiative of the Councils of the NAS and IOM. The study illustrates our ability to act in a more rapid fashion on critical issues as well as the importance of being able to set our own agenda when flexible independent funding is available. Our advice was not specifically requested on this issue but it was felt by the Academy and the Institute to be essential. It is within our Charter responsibility not only to respond to requests for advice, but to identify critical issues and offer advice even if not requested.

Fourth, we are exploring a new mechanism for providing advice, that of establishing a standing council to deal in a continuing fashion with issues that are not episodic but rather are perpetual. Our health technology assessment council is such a model. Only a decade ago the coordination of health technology assessment was a function located exclusively in the Department of Health and Human Services. It failed for lack of support from many of the people it was intended to serve--the health care providers and technology manufacturers. Now, created by federal statute, the new Council on Health Care Technology at the Institute of Medicine is a private-sector body, offering a neutral setting that is attracting broad acceptance and willing participation from those who were most critical of the former government effort. This version of a standing council also provides an interesting funding mechanism. Federal support in the form of matching dollars was able to stimulate funding from the private sector. The result is a joint private-public activity which is at the moment adequately funded. Another example of a persistent set of problems that require continuing discussion is drug development and regulation and we are in the process of forming a separate council for those issues. It is my plan to form a critically-needed third council which will concentrate on the issues of quality, access, and financing of health care.

It is difficult to measure the impact of our advice on policy but it is worth noting that our recent report on quality of care in nursing homes has already been cited as the basis for new legislation, that our studies of personnel needs and training of biomedical and behavioral research personnel have been basis for training grant support, that our study on preventing low birthweight has been translated into legislative initiative, that our study report on research opportunities in alcoholism furnished such a valuable guide to the National Institute on Alcohol Abuse and Alcoholism that they have asked us to conduct it again, and that our studies on vaccine development have been the basis for much activity in Congress. In fact, the health technology assessment council which I discussed was established by Congress in response to an Institute of Medicine report. For those not fully acquainted with IOM's breadth of interests, I have an outline of our program themes with past, present, and projected future activities which I would like to enter into the record.

Ensuring that the advice of the Institute, ranging across the entire health enterprise, is translated into policy is a complex issue. The support of basic biomedical research is predominately a federal government activity, but the organization and delivery of health care and its financing are greatly decentralized and have important regional, state, and local components. We are exploring ways of improving the impact of our reports. We are attempting to develop a clear strategy for dissemination to appropriate target groups before we initiate a study. The question of dissemination is one not only of target groups but of mechanism. We are considering expanding from our traditional detailed reports into brief summary documents, books for use by the public, video tapes for teaching in colleges and high schools, and even new meeting formats for enhancing the linkage between scientists and policymakers.

These comments have necessarily been brief, but I hope they have illustrated the commitment of the Institute of Medicine to maintain the quality of its deliberations while enhancing the timeliness of its advice. We are trying to provide that advice in the most usable form to as many components of our society as required to translate it into policy. We recognize that the government is faced with the apparent paradox of having great scientific opportunities for benefiting mankind while potentially having to limit access to those benefits. To make these and other most difficult choices you will require the most thoughtful, expert, and timely advice possible. Providing that advice is our reason for being, and we will continue to explore strategies, organizational changes, and financing mechanisms to perform our job more effectively.

PROGRAM THEMES

Quality of Health Care

Health Care Organization, Financing, and Accessibility

Maternal and Child Health

Health of the Elderly

Fostering Productive Research

Technologies for Health Care

Meeting Manpower Needs

Behavioral Dimensions of Health

Substance Abuse and Addictive Behaviors

Legal and Ethical Issues in Health

Improving Health in Developing Countries

QUALITY OF HEALTH CARE

Public and private efforts to hold down the costs of health care pose some major consequences for the quality of care. Quality and cost are inextricably coupled in our regard of durable goods, but does that concept of linkage extend fully into services such as health care? A complete answer awaits better techniques for measuring the quality of care, clearer definitions of what care we want in the myriad situations of disease, and development of methods for monitoring and assuring quality. Since its inception the Institute of Medicine has conducted inquiries into issues of health care quality. A list of some major results of this enterprise follows.

- Reports and conferences on care of the dependent elderly, including the recently completed report, Improving the Quality of Care in Nursing Homes

- Several reports laying foundations for the assessment of medical technology, including Medical Technology and the Health Care System, 1979, and Assessing Medical Technologies, 1985

- Reliability of Hospital Discharge Abstracts, 1977-1980, three studies examining the accuracy of leading data bases on the nature of hospital care

- Assessing Quality of Health Care, 1976, an evaluation of the effectiveness of PSROs and precursor health care review programs

- Advancing the Quality of Health Care, 1974, a statement of basic principles for addressing issues of quality

- Contrasts in Health Status, a three part study
  Volume 1 - Infant Death: An Analysis by Maternal Risk and Health Care, 1973
  Volume 2 - A Strategy for Evaluating Health Services, 1973
  Volume 3 - Assessment of Medical Care for Children: An Analysis of Contrasting Forms of Delivery, 1974

In addition, many IOM studies on other topics have important implications for quality of care. Examples include:

- For-Profit Enterprise in Health Care, 1986
- Preventing Low Birthweight, 1985
- Community Oriented Primary Care: A Practical Assessment, 1984
- Medical Education and Societal Needs, 1983
- Sleeping Pills, Insomnia, and Medical Practice, 1979
- A Manpower Policy for Primary Care, 1978

Building on these previous activities, the Institute of Medicine intends to develop a strengthened program to help improve ways of measuring, monitoring, and defining the health service needs of our entire population. This program effort will include the activities of the Council on Health Care Technology, currently being organized by the Institute under a congressional mandate to provide a public-private consortium for addressing technology assessment issues. Additional components of the program under consideration:

- a state-of-the-art assessment of techniques for measuring the quality of care, outlining areas for needed research
- a study of needs and methods for research on health care outcomes
- defining the value of cognitive and psychosocial health services and means of measuring outcomes of those services
- a study and assessment of mechanisms for continued monitoring of quality of care, including institutional, professional, and governmental mechanisms
- examination of the relationships between access and quality (a component of an approved study proposal)
- exploratory examination of the quality of care in the Department of Defense

In other studies the Institute will also continue to examine the health services needs of certain population groups, such as the poor, the homeless, and long term care needs for the elderly.

HEALTH CARE ORGANIZATION, FINANCING, AND ACCESSIBILITY

The same pressures for control of health care costs that may affect its quality also have fostered new organizational and financial structures among the providers of care. Insurers expand their activities into the delivery of health services; hospitals create health maintenance organizations and other finance-based entities. Providers of care begin to compete on the basis of their prices for services and the federal government experiments with rate-setting for the hospital costs of elderly and indigent patients. All of these shifts from the traditional modes of practice and payment affect access to health care for many millions of Americans. The Institute of Medicine has long studied aspects of organization, financing, and accessibility of health care. Its reports directed squarely to those issues include:

- For-profit Enterprise in Health Care, 1986
- Preventing Low Birthweight, 1985
- Community Oriented Primary Care: A Practical Assessment, 1984
- Nursing and Nursing Education: Public Policies and Private Actions, 1983
- Health Services Integration: Lessons for the 1980s, 1982
- Health Care in a Context of Civil Rights, 1981
- Health Planning in the United States, 1981
- Public Policy Actions for Better Dental Health, 1980
- A Manpower Policy for Primary Health Care, 1978
- Controlling the Supply of Hospital Beds, 1976
- Health Maintenance Organizations: Toward a Fair Market Test, 1974
- Disease by Disease Toward National Health Insurance? 1973
- New Members of the Physician's Health Team: Physicians Assistants, 1970

- Reforming Physician Payment, conference report, 1984
- The New Health Care for Profit, papers for a study, 1983
- Community Oriented Primary Care, report of a conference, 1982
- International Dental Care Delivery Systems, proceedings, 1978
- Reimbursement Policies for Primary Care, conference report, 1978
- Implications of Guaranteeing Medical Care, papers of the annual meeting, 1975
- Controls on Health Care, papers of a conference on regulation, 1974

From this base of accomplishments, the Institute is completing planning for a study of long-term care needs, has begun an investigation of government responsibilities in the public health programs of the future, and is developing inquiries into the monitoring of access to care and the problem of health care for the homeless.

MATERNAL AND CHILD HEALTH

All the operating divisions of the Institute of Medicine have been engaged at one time or another with problems related to maternal and child health. The issues range from measuring quality of care for mothers and children to a research agenda on improving the content of prenatal care. Among the IOM reports with important information to improve maternal and child health are the following.

- New Vaccine Development: Establishing Priorities, Volume 2, 1986
- Five reports evaluating a PHS study on the Reye syndrome, 1985-1986
- Preventing Low Birthweight, 1985
- Vaccine Supply and Innovation, 1985
- New Vaccine Development: Establishing Priorities, Volume 1, 1985
- Research Issues in the Assessment of Birth Settings, 1982
- Public Policy Options for Better Dental Health, 1980
- Evaluation of Poliomyelitis Vaccines, 1977
- Three volumes on Contrasts in Health Status, 1973 and 1974
  Volume 1 - Infant Death: An Analysis by Maternal Risk and Health Care
  Volume 2 - A Strategy for Evaluating Health Services
  Volume 3 - Assessment of Medical Care for Children: An Analysis of Contrasting Forms of Delivery

A number of ongoing efforts and initiatives relate to this topic. These include the preparation of a report on a recent Revson conference on maternal and child nutrition in the developing world, a panel on the mental health of children, an examination of policies for day care, prevention of lead toxicity in children, and outreach to enroll high risk women in prenatal care. A committee on Vitamin E toxicity in neonates is completing its study.

HEALTH OF THE ELDERLY

Substantial increases in the number and proportion of older Americans in the decades ahead portend significant changes for our society. The changing age structure of the population will have major implications with respect to such issues as the financing, development, organization, and use of health care resources, and the quality of life of the population, including functional status and well-being across the entire life course. Over the years, the IOM has conducted a number of studies or conferences that address the improvement of conditions for our older population. Examples of the reports include:

- Improving the Quality of Care in Nursing Homes, 1986
- America's Aging: Productive Roles in an Older Society, 1986
- America's Aging: Health in an Older Society, 1985
- Bereavement: Reactions, Consequences, and Care, 1984
- Airline Pilot Age, Health, and Performance, 1981
- Health, Behavior, and Aging, 1981
- Aging and Medical Education, 1978
- The Elderly and Functional Dependency, 1977
- Medicare-Medicaid Reimbursement Policies, 1976
- Care of the Elderly: Meeting the Challenge of Dependency, 1976

A report is being completed for planning of a study on long term care.

New initiatives represent continuing interest and commitment to the theme of improved aging. These include a project on health promotion and disease prevention for the second fifty years of life, a reexamination of ways to foster the development of leadership for geriatric medicine, and a research agenda on aging.

FOSTERING PRODUCTIVE RESEARCH

From the publication of its first study report in 1972 the Institute of Medicine has been concerned with the scientific underpinnings of health. The Institute has sought to call attention to research needs as well as identify research priorities. Funding, manpower, instrumentation, peer review, and other aspects of the infrastructure of research also receive attention as important influences on productivity in the health sciences. Examples of previous IOM activities include:

- Research Briefings, a series prepared by the IOM under the aegis of COSEPUP, assess the status of a field and identify areas likely to return the highest scientific dividend. In the past four years, six of 28 briefings have been in the health sciences, on topics identified by the IOM.
- Responding to Health Needs and Scientific Opportunity: The Organizational Structure of the National Institutes of Health, 1984, analyzes the growth of NIH, calls for a formal process to evaluate the need for new institutes, and recommends administrative and funding changes to meet future needs.
- Alcoholism, Alcohol Abuse, and Related Problems: Opportunities for Research, 1980, identified the most promising directions for research in the next five years, during which time NIAAA used the report as a framework for assessing its research program and for plotting future directions.

The Institute agenda continues to address means to foster productive research. This year an update on the 1980 alcohol-related research report will be prepared, two health sciences Research Briefings are scheduled, and there are development efforts underway for projects on promoting research collaboration across disciplines and on scientific misconduct.

A complete listing of study reports, conference summaries, and individual papers focusing on aspects of biomedical and behavioral research follows.

- Stabilizing the Funding of NIH and ADAMHA Research Project Grants, a paper, 1986

- Preventing Low Birthweight, 1985
- Bereavement: Reactions, Consequences, and Care, 1985
- Research and Training for the Secret Service, 1984
- Research on Mental Illness and Addictive Disorders, 1984
- Health and Behavior: Frontiers of Research in the Biobehavioral Sciences, 1982
- Research Issues in the Assessment of Birth Settings, 1982
- Stress and Human Health, 1982
- Toxic Shock Syndrome: Current Information and Future Research Needs, 1982
- Airline Pilot Age, Health, and Performance, 1981
- Marijuana and Health, 1981
- Behavioral Science and the Secret Service, 1981
- Clinical Investigations in the 1980s: Needs and Opportunities, 1980
- International Policies for Cancer Research, 1980
- DHEW Health Research Planning, Phase II, 1980
- U.S. Participation in Clinical Research in Developing Countries, 1980
- Health Services Research, 1979
- Sleeping Pills, Insomnia, and Medical Practice, 1979
- DHEW Research Planning Principles: A Review, 1979
- National Cancer Program Plan, A Review, 1972

Program development activities include a study of ways to promote research collaboration across scientific disciplines, an examination of scientific misconduct and possibilities for lessening its consequences, and an investigation of options among funding policies for the health sciences.

TECHNOLOGIES FOR HEALTH CARE

Hundreds of new technologies enter the health care system each year, offering new ways to prevent, detect, and treat disease. The benefits of new technologies often are clear and convincing, but some new technologies have posed risks to patients. Some risks are intrinsic to the technology; others are related to the skill with which it is applied or the setting in which it is used. Some new technologies, as well as the changing age distribution of our population, are increasing the costs of health care, sometimes dramatically.

The Institute of Medicine has long been concerned with fostering the development of new technologies for health care as well as their proper evaluation. Among the reports issued through these efforts are the following:

- A series of research briefings on neurobiology, immunology, and the arteriosclerotic processes
- New Vaccine Development: Establishing Priorities Volume 1: Diseases of Importance in the United States, 1985
- Assessing Medical Technologies, 1985
- Vaccine Supply and Innovation, 1985
- A series of five reports on the PHS study of the Reye syndrome, 1984-1985
- A Consortium for Assessing Medical Technology, 1983
- Evaluating Patient Package Inserts, 1979
- Medical Technology and the Health Care System, 1979
- Pharmaceutical Innovation and the Needs of Developing Countries, 1979
- Sleeping Pills, Insomnia, and Medical Practice, 1979
- Evaluation of Poliomyelitis Vaccines, 1977
- Computed Tomographic Scanning, 1977

New program initiatives include the establishment of a Council on Health Care Technology, a forum to consider the development of pharmaceuticals, and an updated evaluation of poliomyelitis vaccines.

MEETING MANPOWER NEEDS

Maintaining an adequate supply of appropriately trained health personnel to meet health needs is a continuing theme of the Institute of Medicine program. A set of public and private sector policies influence the adequacy of the supply and distribution of health personnel and the appropriateness of their training. The starting point is the number of persons educated and licensed in the several health professions. Then there must be consideration of how supply, demand, and roles change over time as a result of such diverse factors as advances in the health sciences, demographic changes, availability of loans and scholarships, malpractice liability, and changing perceptions about need. Examples of IOM reports of particular timeliness or lasting value include:

- Personnel Needs and Training for Biomedical and Behavioral Research, part of an ongoing series, has made recommendations that were subsequently adopted on federal scholarship and fellowship policies to bring supply in closer conjunction with needs.
- Nursing and Nursing Education: Public Policies and Private Actions, 1983, allayed fears of an overall nurse shortage and suggested how federal support would best be applied to nursing.
- Costs of Education in the Health Professions, 1974, devised methods that continue to be employed as a basis for policy analyses.

A complete list of publications concerning health manpower follows.

- Plan for a Study to Develop Methods Useful to the VA in Estimating its Physician Needs, 1985
- Personnel Needs and Training for Biomedical and Behavioral Research, 1983-1985
- The Career Achievements of NIH Predoctoral Trainees and Fellows, 1984
- Research and Training for the Secret Service: Behavioral Science and Mental Health Perspectives, 1984

- Medical Education and Societal Needs: A Planning Report for the Health Professions, 1983
- Nursing and Nursing Education: Public Policies and Private Actions, 1983
- Community Oriented Primary Care: New Directions for Health Services, 1983
- Health Services Integration: Lessons for the 1980s, 1982
- Graduate Medical Education and Military Medicine, 1981
- Physicians and New Health Practitioners: Issues for the 1980s, 1979
- Aging and Medical Education, 1978
- A Manpower Policy for Primary Health Care, 1978
- Beyond Malpractice: Compensation for Medical Injuries, 1978
- Medicare-Medicaid Reimbursement Policies, 1976
- Costs of Education in the Health Professions, 1974
- Manpower for Health Care (1974 Spring Meeting papers), 1974
- Educating for the Health Team, 1972
- New Members of the Physician's Health Team: Physicians Assistants, 1970

Under way or in the planning stage are studies of the roles of allied health personnel, the function of psychiatry in an academic health center, leadership requirements for geriatric research and training, and the capacity of the United States to undertake research in tropical diseases. Other projects in development include a study of the worsening malpractice insurance situation in the United States. Work will continue, accordingly as requested, on studies of national needs for biomedical and behavioral research personnel.

BEHAVIORAL DIMENSIONS OF HEALTH

The Institute of Medicine has been in the forefront of efforts to raise awareness of the relationships between behavior and health. The breadth of behavioral contributions to health problems was suggested in the early 1980s by a federal agency estimate that 50 percent of the mortality from the nation's 10 leading causes of deaths was attributable to factors of behavior and lifestyle. Examples of reports from IOM activities include:

- Bereavement: Reactions, Consequences, and Care, 1984, was focused on a particular group of stressors, those associated with loss by death of a close relative.
- Health and Behavior: Frontiers of Research in the Biobehavioral Sciences, 1982, a synthesis of a series of conferences begun after the IOM helped in the preparation of the Surgeon General's report, Healthy People.
- Stress and Human Health: Analysis and Implications of Research, 1981, was the result of a specific request from the White House Office of Science and Technology Policy to examine research issues raised by the consequences of stress.

Newly under way is a study to review the many aspects of pain, especially chronic pain, at the request of the Social Security Administration. The study report will describe research opportunities to promote understanding of the multiple categories of pain and the various influences on pain behavior, foster improved measurement techniques, and contribute to more successful intervention strategies for rehabilitation of chronic pain patients. The committee will also offer recommendations regarding the way pain is evaluated in medical practice and the way disability is defined within the Social Security disability system and elsewhere.

SUBSTANCE ABUSE AND ADDICTIVE BEHAVIORS

The Institute of Medicine has been concerned with a variety of substance abuse problems over the past decade, including not only alcohol and tobacco but also marijuana and certain prescription drugs. Examples of reports from IOM activities include:

- Marijuana and Health, 1982, which was widely quoted and has become the definitive review of the subject to date.
- Health and Behavior, 1982, was influential in several respects with the federal research effort to curb cigarette smoking.
- Alcoholism, Alcohol Abuse, and Related Problems: Opportunities for Research, 1980, proved to be so helpful to the responsible federal agency (NIAAA), both internally as a planning document and externally as a description of scientific challenges in the field, that IOM has been asked to update the report to cover the next five years.
- Sleeping Pills, Insomnia, and Medical Practice, 1979, which made recommendations that were implemented by a joint public and private sector activity, including the Public Health Service and pharmaceutical manufacturers, to inform the public about sleep problems and to aid physicians in responding to their patients' sleep complaints. The study also played a role in promoting research efforts on sleep problems and in influencing development and marketing of certain types of medication.

Currently, the Institute is involved in helping the Public Health Service appraise the health efforts of smokeless tobacco.

LEGAL AND ETHICAL ISSUES IN HEALTH

Cutting across the entire range of IOM activities are the legal and ethical concerns implicit in any aspect of health care and research. A longstanding conviction of the importance of these concerns on the part of the Institute resulted in a varied collection of study reports and papers bearing directly on legal and ethical considerations. A list of principal examples follows.

- For-profit Enterprise in Health Care, 1986, assays investor-owned facilities and entrepreneurial physicians.
- The New Health Care for Profit, 1983, contained papers both on hospitals as corporations and physicians as businessmen.
- Access to Medical Review Data, 1981, suggested how a line could be drawn between physician confidentiality and the public's right to know.
- Health Care in a Context of Civil Rights, 1981, described racial and other factors associated with disparities in patterns of care.
- Behavioral Science and the Secret Service, 1981, reported on problems of managing dangerous behavior.
- Evaluating Patient Package Inserts, 1979, helped the Food and Drug Administration strike a balance between contentions that more information about our medicines would (1) help, (2) hinder our recovery of health.
- Food Safety Policy: Scientific and Societal Considerations, 1979, took the issue of saccharin and carcinogenesis into a proposed new regulatory scheme of graduated risks and responses.
- Beyond Malpractice: Compensation for Medical Injuries, 1978, began construction of a model system of coverage for victims of medically-related loss.
- Ethical Issues in Governmental Effort to Promote Health, 1978, a paper analyzed the steps toward coercing well-being.

- The Rights of Physicians, 1978, is an essay setting out the health care professional's side of the equation if the citizenry has a "moral right" to care.
- Implications of Guaranteeing Medical Care, 1975, the papers of that year's annual meeting, explored the consequences of government assurances of care.
- Legalized Abortion and the Public Health, 1975, examined the consequences of the first year's experience following the Supreme Court's ruling that separated abortion from criminality.
- Ethics of Health Care, 1973, constituted the proceedings of a seminal conference on health care and changing values.

New initiatives in the legal-ethical theme include a proposed study of the issues raised by medically-assisted conception, plans for an up-to-date examination of malpractice litigation as it affects the performance of health care, and a substantial consideration in the current study to design a national strategy of research and health care for AIDS (acquired immune deficiency syndrome).

IMPROVING HEALTH IN DEVELOPING COUNTRIES

Reports of the Institute of Medicine reflect a decade of active engagement in concerns for the health of people in countries whose burden of disease often is one of the biggest impediments to their successful economic and industrial development. The wide variety of possible approaches for inquiries into these matters is demonstrated by the reports they have produced, as in the following examples.

- New Vaccine Development: Establishing Priorities, Volume 2: Diseases of Importance in Developing Countries, 1986
- The U.S. Capacity to Address Tropical Disease Problems, 1986
- U.S. Participation in Clinical Trials in Developing Countries, 1980
- Health in Egypt: Recommendations for U.S. Assistance, 1979
- Pharmaceuticals for Developing Countries, 1979
- Strengthening U.S. Programs to Improve Health in Developing Countries, 1978
- Review of the AID Health Strategy, 1978
- International Dental Care Delivery, 1977

In addition, there continues a Mid-East Health Research Initiatives program (promoting Egyptian-Israeli-U.S. collaborative health research). The Institute also intends to extend its inquiries beyond the traditional "diseases of poverty" and begin an examination of the health problems that accompany development.

The Division of International Health is working on proposals to examine strategies for monitoring occupational and environmental health hazards in developing countries and to mobilize against smoking in developing countries. An exploratory workshop is planned on improving the contribution of U.S. institutions of higher education to health sector needs in developing countries.

Mr. **Fuqua**. Thank you very much, Dr. Thier.

PANEL DISCUSSION

Mr. **Fuqua**. It appears that the Institute of Medicine has introduced a number of innovative mechanisms to produce some timely and useful information. Do you think that these approaches would be available in the National Academy of Sciences as well as in the National Research Council, and the fact I think, as I understand it from your testimony, that you conduct your own studies rather than having to go through the National Research Council. I am wondering if that helps accelerate the process?

Dr. **Thier**. We do conduct our own studies, but we do not do them independently of the National Research Council.

Mr. **Fuqua**. Do you seek approval from them?

Dr. **Thier**. We seek final approval from them, yes.

Mr. **Fuqua**. At the beginning or the end of the study?

Dr. **Thier**. At the beginning of the study and it goes through the review process.

Mr. **Fuqua**. Same as it would be for any other study?

Dr. **Thier**. Yes, sir, there is a sense of independence which is invigorating, but the actual process runs through the NRC. I think that is wise, because there is a lot of overlap between segments of the National Research Council and their interests, and the interests of the Institute. So we do pursue that coordination. More important in being able to keep timely in our advice is having some degree of private, flexible funding which can be tapped in terms of need as opposed to going through complicated contracting mechanisms which frequently slow the pace at which we can respond.

Mr. **Fuqua**. I notice that you indicate that was about 30 percent.

Dr. **Thier**. That is correct.

Mr. **Fuqua**. Is that a good balance, or should it be more, or should it be less, or is that just a figure that you arrived at. Was there any reason for that.

Dr. **Thier**. I think that that figure evolved, rather than was planned, and I think it evolved because of the more intense interest of a certain subset of foundations in the health arena, and much of that funding is from the foundation group. I tend to think that something in that range, perhaps as much as 40 percent, would be useful funding, but I would not in any way wish to see that be the majority funding of our activities. That is not our first commitment, that is to the Government.

Mr. **Fuqua**. Dr. Press, let me ask you and Dr. White if there are any steps that the Federal Government should take that would, over the long run, strengthen and augment the ability of the National Academies to conduct self-initiated studies?

Dr. **Press**. We have talked a lot about that for the past decade. My predecessor was actually quite concerned about the independent funds and possible approaches to Congress and the Government about that kind of unrestricted support. He argued that very often the Government might be a party of interest to the outcome of a certain study or might be too reluctant because of certain political consequences, yet nevertheless would like to see us embark in some of these areas and the funds weren't available. That is what we are doing right now. All of us are involved in a coordinated campaign to do that.

The problem of the Government providing that support would arise from our basic relationship with the Government, with Congress, which would change as a result of this kind of contribution. We value most of all our role as the private sector, friendly allies, as Judge Sirica described it. We value that role, that very special role, and we get certain prerogatives as a result of that.

Many agencies will come to us as sole sources because of that charter, because we don't charge a fee. In that sense, that unique relationship, if that were to change as a result of a Government endowment or fee structure, I think it would not be worth the advantages. If there are other ways of accomplishing that goal without changing the century-long relationship that I described, that would be worthy of discussion.

Dr. White might have some——

Dr. WHITE. I subscribe to Dr. Press' comment. I would merely like to point out that the situation now exists where the parts of the institution have some of their own independent funds, raising additional funds in the private sector. This enables us in many cases to match funds that come from the agencies of the Federal Government. Funding arrangements seem to be working right at the moment. They put us on our mettle. They ensure responsiveness to requests from various agencies, and enable us to involve the private sector. So the funding arrangements seem to be working reasonably well now, Mr. Chairman.

Mr. FUQUA. Well, I know in the National Academy of Engineering, that you have encouraged industrial participation for sometime, probably more so than the National Academy of Sciences. I gather from the testimony that continues to be the case. I am wondering if this is a situation that could develop where industry can or has dominated the effectiveness of providing scientific and technical advice to the Federal Government?

Dr. WHITE. Well, I think all parts of the institution have received funds from industry as a function of particular studies. In the case of the National Academy of Engineering, we do have a program of fundraising, part of which is directed at industry, but also directed to the foundations and private individuals. But the funds which we are raising go into a common pool of money. The decisions as to how the money is used are made by ourselves. There is no way in which an individual entity, industrial or otherwise, can determine what it is we study, or who are on the committees, so it all goes into a common pool of funds.

Mr. FUQUA. Is that true of the national academy?

Dr. PRESS. Well, it is the common pool that we all use and draw from together, so we raise these funds together.

Mr. FUQUA. Including IOM?

So the question came up came up yesterday, if private funds were used to fund specific programs, should the source of those funds be made public. I gather from what you are saying that would not be necessarily be the case, because they are put into a pool of funds, then you draw from that, I guess, along with the Federal funds, to conduct self-initiated studies?

Dr. **Press**. Mr. Chairman, all of our reports list the sponsors, the financial sponsors for the particular study. In the case of something we call the Academy Industry Program, where there are 70 companies that contribute without strings attached, not knowing how the money will be spent.

Mr. **Fuqua**. Unrestricted funds?

Dr. **Press**. Yes. We simply say the Academy Industry Program supported this project. By and large, in any given project, we try to dilute the sources of support so that the perception of the sponsor controlling the outcome does not exist. So most often, a report would be, a privately supported report would have the support from the Academy Industry Program, from philanthropic foundations, from our endowment and often from the Government as well.

Mr. **Fuqua**. A question that has come up is whether the National Academy of Sciences should infuse policy into its studies, and it was suggested that the academy should place their recommendations in the context of relevant policy issues and leave the policy to the policymakers. Would you care to comment on that?

Dr. **Press**. I was surprised to read that in Dr. Keyworth's testimony. I think he may have raised it.

Mr. **Fuqua**. That is correct.

Dr. **Press**. If you examine our reports, we don't shy away from policy recommendations. If those recommendations can be justified by the scientific and technological component, the expertise of the panel, and if they are not dominated by value judgments, then we don't hesitate to make policy recommendations.

The nursing home report has definite policy recommendations in there that, by and large, are in the proposed legislation already.

I think I would say a goodly number of our reports where the conditions are met that I described, do contain those policy recommendations.

Mr. **Fuqua**. Mr. Packard.

Mr. **Packard**. Thank you, Mr. Chairman.

Dr. White, you have identified in your testimony a number of issues concerning the technical ramifications this country will face in the future, and particularly you have mentioned the international competitiveness and how your agency, the technical leadership program, is addressing these issues. Do you see a need or desire to restructure the National Academy of Engineering or the National Research Council to modify the operating procedures to meet the needs of the country and the need of the national academies in the future?

Dr. **White**. No, I don't, Mr. Packard. I think the system we presently have, with the various parts of the institution working together, making use of the various parts of the institution, as is appropriate for particular studies, gives us great flexibility. We have found no difficulty under the present situation in doing just about any kind of study we choose, including studies of international competitiveness and other questions. We have great flexibility in the institution.

Mr. **Packard**. Due to the highly publicized nature of technical issues today, do you think the academy should, or at least the advisory capacities of our agencies ought to be implemented, or do you think it ought to remain—the academies ought to remain—the only technical advisers to the Government?

Dr. WHITE. Well, Mr. Packard, I don't believe that the academies ever visualized themselves as the only technical advisers of Government. Of course, there are many, many groups and institutions that are advising the Federal Government. We just believe that we are one important mechanism with special and unique properties of being able to convene leading authorities from around the United States and bring them to consider particular topics.

Mr. PACKARD. Dr. Press, you mentioned in your testimony, that, during the report review process, an impasse may occur. What procedure does the National Research Council use to facilitate the development of consensus and what is done to help resolve impasses and to minimize impasses?

Dr. PRESS. We do about 300 studies a year. It is a rather large operation. In the past 5 years that I have been in my present position, I can think of only two out of a very large number of studies where that impasse developed, and it could not be resolved. So by and large, the system works well. There is an iteration between the reviewers and the panel that does the work where the differences are ironed out and it prevents our making mistakes, keeps the panels on their toes and ensures credibility and balance.

On those occasions where there is a disagreement, it will come to the executive office of the National Research Council and we will try to act as friends of the court, so to speak, in discussing the issues with both sides, and most of the time we can resolve that. But there is one recent, very highly publicized situation where we could not, and so we abandoned the study. And so one failure of this magnitude over so many years, of so many studies, I think, is rather remarkable. That one failure was in the area of the recommended daily allowances.

Mr. PACKARD. Is that generally the procedure that you become the final word and if it can't be resolved there then is it a generally accepted fact that you would not proceed with the study?

Dr. PRESS. It rarely comes to me. As I said, it is a fraction of 1 percent—less than that—but that is the ultimate——

Mr. PACKARD. The executive board is the final——

Dr. PRESS. Yes, sir.

Mr. PACKARD [continuing]. Stamp of approval required?

Dr. PRESS. Yes, sir.

Mr. PACKARD. Thank you.

Dr. Thier, in your testimony you indicated that many of the efforts undertaken by IOM are directed at influencing policy. Do you think that this direction should continue at the same level in the future or will it increase, actually?

Dr. THIER. My sense is it may well increase. I think the very dramatic, rapidly changing scene in the health area demands that a whole series of questions be asked on everything ranging from the science of medicine to the organization and financing of it. I think our Institute is, apropos of the previous question you asked, uniquely structured in terms of bringing together groups in an advisory function. We have them all within one entity capable of giving us the kind of perspective that I think is broad enough to deal with policy issues.

And in response to the chairman's comments earlier, I think we have viewed, from the beginning, that advice on health policy, informed by scientific data, was our mission and we will continue to provide that. What we may have to explore more is better means of communicating with the State level, because in the area of the health of the public, much of the decisionmaking occurs at that level.

Mr. PACKARD. Have you experienced any problem or any concern between the policymaking efforts that you have been moving in toward with the policymakers of State and Federal Government. Have you found a conflict at all between the two efforts?

Dr. THIER. Not a dramatic conflict. There is always the problem that I think Dr. Press was addressing, that if you are stating a firm position on policy, which is a final choice between a set of options, it tends to have some value commitment to it, as well as data, and people who don't agree with that value sometimes are a little put off by it. But I think the key question is to be sure that we have based our opinion and recommendations on the firmest data available.

Mr. PACKARD. Thank you.

Mr. FUQUA. Dr. Press, you mentioned the communications between science and public policy needs to be improved. How can we do that? Do you have any simple answers?

Dr. PRESS. In the past, for most of our existence, our primary relationship was with the Government agencies and with congressional committees in recent years, and we had no extensive campaign of dissemination of our reports to a wider, and we find, a very interested public. But now we are having a number of different avenues for a broader communication with the public, with State and local governments as well, with the industrial and academic sector. We find that our recommendations often have dual use or dual application, not only to Government agencies, but also to elements of the private sector. So in a number of different ways and mechanisms, we are enhancing that ability to communicate, to educate, and to raise these issues of policy for general discussion. That is a big effort and we are trying in that direction.

I must say that also in the past our reports have tended—if you look at the reports, I think we submitted for the record a volume describing all of the reports we have issued over the years since the war—it is interesting to go through the year 1950, compared to the year 1985. In 1950, the reports were very, very narrow, very antiseptic, very specially defined, narrow scientific issues, of very specific disciplines. In 1985, they are involved with the issues of the day that the country as a whole faces. Issues of the economy, of agriculture, of health and environment, industrial competitiveness, relations with other countries as they are affected by science and technology, and they are full of actual policy recommendations. So we are moving in that direction over our evolutionary course.

Mr. FUQUA. Thank you.

Mr. Brown.

Mr. BROWN. I am trying to get in my mind a picture of how the academy has grown, developed, adjusted, evolved over the course of the years. It is obviously a dynamic group of institutions. Have these changes been self-motivated, self-initiated, or have they been mandated by act of Congress, or have there been changes in the charter which required you to move in some of these directions, or have you done it in response to your perception of the changing needs of American sciences and society?

Dr. PRESS. I think that the list—all of the above—except we have not had a change in our charter. But we have had a change in the nature of our relationship with Congress. Before, 15 years ago, our relationship with Congress was nonexistent. It was essentially or exclusively with the executive branch. Now, increasingly, by legislation as well as specific committee requests, our involvement with Congress is quite extensive and growing.

So I would say just that, your list, the changing nature of our times, the changing list of national issues, the enhanced role of science and technology in the affairs of our Nation, all of these required institutional changes. The fact there was no engineering academy until 25 years ago and now they are a partner in the governance of the National Research Council; and the same is true with the Institute of Medicine, again shows the changing list of national priorities.

Mr. BROWN. But those two rather major and significant structural institutional additions, those were done without the need for basic changes in your charter; is that correct?

Dr. PRESS. That is correct.

Mr. BROWN. Now, with regard to the changing role of the Congress, how has this affected the funding situation? Do you receive through some regular budgetary allocation—we will say foundation funds supplemented by funding for specific projects, supplemented in addition by what you are now getting from private enterprise on an increasing basis? Is there any scheme or order to this which is easy to represent simply?

Dr. PRESS. It is highly decentralized and essentially each project is a separate funding activity. We get no single appropriation from Congress or any agency of the Federal Government as a lump sum without a very specific charge associated with a project or study that is commissioned, and it is highly decentralized. It is not easy to do it that way, but also it has certain advantages which I described earlier.

Mr. BROWN. Of course, the system which best maintains independence and autonomy is the one which you are seeking to maintain, I presume.

You have not come before us this morning with any, as far as I can perceive, any major suggestion for changes. We discussed briefly yesterday the possibility that your efficiencies, as well as your independence may be enhanced by the development through some process or other of endowment funds, unrestricted endowment funds, which could be contributed to by anyone—prominent scientists on their death could bequeath $10 million to you because they are all rich.

Dr. PRESS. Do you have any recommendations?

Mr. BROWN. Has your thinking considered these possibilities for additional economic security which would not endanger or impair the autonomy and independence of the academy?

Dr. PRESS. Dr. White has a comment to make.

Dr. WHITE. May I turn it around and ask your advice? Do you think it could be achieved without changing the basic relationship with Congress and the executive branch to have that sort of financial security provided by one mechanism or another, by the Federal Government? Do you think that could be achieved without damaging something that has worked well for over a century?

Mr. BROWN. Well, one always hesitates to alter a system that has worked well for over a century, but I will tell you very frankly that I am not all that happy with the role that the academy has played insofar as its depending upon fluctuating political attitudes within the Federal Government. I would like to see the Aaademy escalated from that to a greater degree. So far, I don't perceive any great damage has been done, but I can foresee the possibility.

I don't have a ready response to your question, just as you don't seem to have a ready response to mine, but it is perhaps something that ought to be explored a little more diligently. I put it in the context, as you know, that this group is trying to look 20 years or 25 years down the road, and it is going to be a very difficult road over that period of time, and we would like to create whatever mechanisms are necessary to preserve that stability and autonomy.

Dr. PRESS. I think we have the same goal. I think the need for providing for that stability, that political insulation, is of highest priority, and that is why we are trying to raise such funds privately, and it is not easy to do so. It is a lot of hard work and we don't have an alumni association, it is not an easy case to make, and your suggestion is one that we have considered, but we have the worries that I described.

Mr. BROWN. Did we short circuit you, Dr. White?

Dr. WHITE. I was just going to pick up on your question, Mr. Brown, on getting scientists to make contributions. I want to comment that in fact they are, both scientists and engineers, trying to build the endowment for the academies. Particularly, I would like to mention that we recently received a very, very large grant from an outstanding scientist engineer, Arnold Beckman, to establish a new center for the academies in your State, in Irvine, CA, but which is also accompanied by a very major gift to endow the programs.

While this is the largest gift, contribution, the academies have ever received for this, there are scientists and engineers who similarly have made contributions to the endowments of the academies. We deeply appreciate it and it indicates that that is indeed a direction that we should follow.

Mr. BROWN. I noted that bequest myself and of course, I think the academy and the entire scientific community should be grateful. Mr. Beckman has been extremely generous in his philanthropy and that is the customary way in which great educational institutions achieve their autonomy and capability, and I just would like to feel that the academy did move in that same direction.

Mr. PACKARD. Would you yield?

Mr. BROWN. Yes.

Mr. PACKARD. Have you found in your experience that the greater contributions come from members of the academy? What is the distribution of contributions in relationship to the membership?

Dr. **White**. I don't think we have looked at it in detail. We do have contributions from both members and people who are not members of the academies. We are talking about individuals now, of course. I think the contributions are heavily weighted in favor of members of one of the academies or the other, but there are substantial contributions from others.

Mr. **Packard**. Is the selection process to become members of the academy have any relationship to either the past or potential contributions?

Dr. **White**. No, it does not.

Mr. **Packard**. Thank you.

Mr. **Brown** [acting chairman]. Mr. Volkmer.

Mr. Volkmer has no questions. That doesn't stop me from having an additional question on another area, with regard to the overall role of the academy.

Again looking into the future—the question of scientific exchanges with other countries in the world, again something that tends to fluctuate with the political climate, sometimes not at all related to the values of science or the needs of science on a global basis—has the academy given any thought to the possibilities or possible ways in which that global scientific interchange and the United States role in it could be facilitated by some different institutional argument which would give the academy a more independent role?

Dr. **Press**. That is very pertinent, because to form a stable relationship of exchange, joint research efforts with another country, in an atmosphere of cyclical budget changes, depending on the political climate, is very difficult to do.

We recently signed a new agreement of exchange with the Soviet academy. Before embarking on that negotiation, thanks to a major philanthropic organization, we raised sufficient funds to guarantee stability in the relationship should the Government drift away from support. That was the only way we could even begin discussions as a reliable partner.

After that funding, the biggest impediment was the reluctance of some members in the American scientific community to participate in this on human rights issues and so on, and there we built a consensus over a few years that we should go ahead and do it. With those two actions, we were able to negotiate what might be a very interesting new agreement with the Soviets at a time of very rapid change in that country not only in their government but in their own scientific establishment.

Our relationship with China I think has been a very important one in the history of the relationship of our two countries. The Chinese, many China experts tell me, were led to resume relations with the United States for many reasons, but one important reason was the access to American educational institutions for their people and for scientific cooperation. For almost a decade of that program, it was supported entirely privately because again of the political climate, and even today, we have difficulty in supporting that program. So your point is well taken. We do have to find ways of insulating relationships with other countries based upon changing attitudes and political environments.

In the developing countries area, where we have major programs, I think some of our best programs in terms of global contributions, there again the popularity and unpopularity of the AID budget with Congress and the executive branch as you know, goes up and down over the years, and that has been more significant. There we have been essentially whipped back beyond our control. It is unfortunate, but that is what has happened.

Mr. **Brown**. What was the scope, size of the private financial endowment that allowed you to reinstitute the Soviet agreement with the confidence that you indicated?

Dr. **Press**. It was on the order of $500,000 a year for 10 years. That is more stability than we usually have.

Mr. **Brown**. Yes.

Dr. **Press**. Not to be expended unless it was called upon. In other words, it was the stabilizing fund to back up the changes within the Government support.

Mr. **Brown**. And, of course, you didn't mention the fiasco of IIASA, which still rankles me somewhat. That could have been prevented if there had been private funds available for stabilizing purposes also, I presume.

Dr. **Press**. That is a good example.

Mr. **Brown**. Then we have some programs—I am thinking of the United States-Mexico program, which seems to just—there is no particular political problem there, it just waxes and wanes because it drops out of people's minds I think, more than anything else.

All right, you haven't solved the problem for me, but I appreciate your comments.

I think we have no further questions for you gentlemen. It always is a pleasure to see you. We hope to see you again soon.

You have promised us, I think—didn't you promise, Dr. White, you were going to submit some additional recommendations in our statement.

Dr. **White**. We have had a committee of our academy working to try to draft some views and recommendations for this task force. We will be submitting them, yes sir.

Mr. **Brown**. Thank you very much. We will keep in touch with you.

Mr. **Brown**. Our last witness this morning is Dr. Denis J. Prager, who is deputy director for health programs for the MacArthur Foundation. We are glad to see you again, Dr. Prager, and you may proceed with your statement in any way you wish. The full text will be in the record, of course.

STATEMENT OF DR. DENIS J. PRAGER, DEPUTY DIRECTOR; HEALTH PROGRAM, JOHN D. AND CATHERINE T. MacARTHUR FOUNDATION, CHICAGO, IL

Dr. **Prager**. Thank you, Mr. Brown. It is always a pleasure to see you. I am glad to be back in Washington testifying after a couple of years' absence. I appreciate your putting the entire testimony in the record, and I will try to be brief and to summarize from what I have written.

As you noted, I am currently a senior program officer of the MacArthur Foundation, located in Chicago. Immediately before joining the Foundation, I spent 6 months at the National Academy of Sciences establishing the then new Government-University-Industry Research Roundtable. As you have also noted, prior to that, I was for 5 years a member of the staff of the White House Office of Science and Technology Policy. It is from these perspectives that I would like to address the topic of this hearing—the role of the national academies in providing scientific, technical, and policy advice to the Federal Government.

First, I would like to take this opportunity to congratulate the chairman, the members of the task force, and the members of the committee for their foresight in perceiving the need for a broad-ranging study of American science policy and for their perseverance in pursuing its ambitious goals. In my opinion, this comprehensive review comes at a critical time in the evolution of American science and technology. We are entering a time of unprecedented intellectual ferment in science when we can anticipate extraordinary advances in our knowledge of the natural world in which we live and in our ability to apply that knowledge to improving the well-being of the American people as well as other citizens of this planet. At the same time: one, there are serious questions being raised about the adequacy of the university infrastructure on which we depend for the conduct of basic research; two, there are severe pressures to reduce the tremendous Federal deficit which threatens the economic viability of this Nation; three, serious concern is being expressed about the social consequences of scientific and technological advances; and four, there is growing pressure to focus an ever larger proportion of the science budget on research which directly supports military or industrial competitiveness objectives.

In light of these growing economic and social pressures and concerns and the difficult public policy decisions they imply for the Congress and the President, it seems clear that there will be an ever increasing need for independent, objective, and timely scientific and technical advice on: opportunities in science and technology, priorities in the allocation of scarce resources, problems and needs in the science and technology enterprise and the intended and unintended consequences of scientific advances and their technological applications.

In these brief remarks, I wish to address the roles of the national academies in providing such advice, focusing particularly on their future roles and on the need to protect their independence as they attempt to fulfill them.

The National Academy of Sciences has a long and distinguished history of responding to congressional and executive branch requests for competent and timely advice on scientific and technological issues confronting the country. Because the National Academy of Sciences has access to the best minds in a broad range of scientific disciplines and areas of expertise, it is able to mobilize the expertise required to provide advice on an extensive array of issues. It is my perception that the National Academy of Sciences is still perceived as this country's preeminant source of objective scientific advice. It is also my perception, that the National Academy of Engineering has, in only two decades, established itself as a highly credible source of information and advice on the kinds of technological issues of increasing interest and concern to the people of this country and their appointed and elected representatives.

However, in my opinion, the newest member of the national academies, the Institute of Medicine, has yet to meet the expectations which many of us in the health and biomedical sciences have for it. For a number of reasons related to the breadth of its mandate and the diversity of its membership, scarcity of resources, inadequacy of professional staff and leadership, and its relationship to the National Academy of Sciences, the Institute of Medicine has not as yet established itself as the premier source of advice on the tremendous range of health, medical, and biomedical science issues facing the country at this time. In this regard, I am personally most pleased and heartened that Dr. Samuel O. Thier has recently assumed the presidency of the Institute of Medicine. Under Dr. Thier's capable and energetic leadership, I am optimistic that the Institute of Medicine will address the several substantial institutional issues to which I have briefly alluded, and will, accordingly, improve the quality and timeliness of its studies and reports.

THE NEED FOR ADVICE

As I stated in my introductory remarks, there seems little doubt that the elected and appointed leaders of this country will increasingly be faced with extremely difficult and politically charged choices and decisions concerning scientific and technological priorities, and the allocation of scarce resources to pursue those priorities. And, even as the number and difficulty of these decisions grow, so will the sophistication and complexity of the science and technology about which they are concerned. As we delve deeper into the molecular and atomic structure and function of nature, so, too, do we increasingly limit the number of people capable of understanding that structure and function, the nature and importance of the research being conducted, and the potential applications and unintended side effects of the new knowledge being discovered. For that reason, those responsible for guiding this country in the future will have an ever-growing need for objective and timely advice on which to base hard choices and difficult decisions.

The President and his executive branch departments, and agencies have at their disposal, a broad array of potential sources of scientific and technical advice. These include: one, internal offices and committees established to advise agency leadership on difficult scientific and technological issues; two, external councils, panels, committees, and boards established by agencies as means for obtaining advice from outside experts; three, professional associations and societies; and four, the National Academies.

INTERNAL AGENCY MECHANISMS

In my opinion, internal agency offices, committees, and other mechanisms comprised of full-time agency employees are not, by themselves, adequate sources of objective and competent advice on the increasingly complex scientific and technological issues facing the Federal departments and agencies. These offices are chronically plagued by inadequate financial and staff resources, by difficulty in recruiting and retaining highly qualified, full-time scientists and engineers, and by the inherent captive and nonindependent nature of the advice which such mechanisms represent.

Perhaps, the most prominent and visible example of the problems associated with such internal advisory mechanisms is the Office of Science and Technology Policy, established by the Congress to advise the President on scientific and technological issues facing the country and on the management of the Federal science and technology establishment. All of the limitations and difficulties mentioned above apply in spades at OSTP. Financial resources and staff positions are chronically limited by OMB, and, for this reason, the staff comprises a mixed bag of individuals detailed from various executive branch departments and agencies.

However, the greatest challenge facing OSTP is the degree to which it can maintain its position as a source of highly competent, objective advice in the highly charged maelstrom of the Executive Office of the President. An OSTP director, sensitive to this challenge and committed to protecting the objectivity of the Office, is constantly caught in the conflict of trying to be an objective adviser while still being perceived by his Executive Office colleagues as a team player. The success of the Office as a true, objective advisory mechanism depends, to a large degree, on the ability of the director to survive in this tense and ambiguous context. Since I served under two OSTP directors in two, quite different administrations, perhaps my perspective might be helpful.

Under the Carter administration, the OSTP Director and science adviser, Dr. Frank Press, strove particularly hard to protect the objectivity of the office. It is my perception that Dr. Press attempted, in all cases of which I am aware, to provide the President with the best scientific and technical advice he could muster, regardless of its political consequences. He understood, I believe, that there were many others on the White House staff whose primary concern was providing political advice to the President, and that his role on the team was to provide competent, timely, and objective scientific and technological advice. It is my perception also, that Dr. Press was highly successful in this regard although in many cases, it drew the ire of many of his White House colleagues.

In sharp contrast, is the Office of Science and Technology Policy under the Reagan administration. Dr. George A. Keyworth II, who, until recently, was the director of OSTP and science adviser, came into the Office committed to maintaining his objectivity and providing his best advice to the President free of political or ideological bias. However, in a relatively short time, Dr. Keyworth became a strong partisan and outspoken political advocate, eschewing objectivity and embracing a number of Presidential political positions to which he previously was unalterably opposed, including foremost, strong opposition to the Strategic Defense Initiative. It is my opinion, that, under this administration, OSTP has become a highly politicized office dedicated primarily to furthering the President's goals and programs in defense, space, and industrial competitiveness. The one formal external advisory mechanism—the White House Science Council—which many hoped would fill the role of providing objective advice to the President, suffers from similar limitations. Since, instead of reporting to the President, it advises the science adviser himself, the Council can be, and has been, shaped and manipulated by the OSTP director to serve the political purposes of the administration.

While not wishing to dwell on this particular example, I think it does illustrate the inherent limitations of such internal advisory mechanisms and sharpens the need for independent external advice.

EXTERNAL ADVISORY COMMITTEES

Most Federal departments and agencies dealing with the support and or conduct of scientific research and technical development utilize a range of committees, panels, and boards to provide advice on everything from questions of agency directions and priorities to the evaluation of individual research proposals and agency programs. In general, it can be said that, the more an advisory committee is concerned with providing advice on the scientific merit and relevance of technical adequacy of special research proposals or programs, the more objective and independent the advice. For, in most cases, these peer review panels are comprised of scientists and engineers selected only on the basis of their experience and expertise in relevant scientific and technological areas. However, the more agency advisory committees deal with agency policies and priorities, the more such panels are vulnerable to political manipulation. In fact, in many cases, the members of such policy committees and boards are appointed by the agency head or the President on the basis of selection criteria which vary from administration to administration and agency head to agency head. For example, in this administration, every effort has been made to assure that individuals appointed to agency and department policy boards have a political ideology consistent with that of the President. Although it is not unreasonable to expect Presidential appointees to reflect his beliefs, fealty to the President should not be the sole, or even the predominant, selection criterion for members of panels established to advise on scientific and technological policy issues.

PROFESSIONAL SOCIETIES AND ASSOCIATIONS

There are literally thousands of associations and societies representing the interests of scientists and engineers, generally, or of disciplines or areas of interest, specifically. To the degree that such organizations are capable of mobilizing the kind of expertise required to address important scientific or technological questions at a technical or policy level, they represent a potentially important resource for executive branch departments and agencies grappling with those issues. However, it is widely perceived by the leadership of those departments and agencies that most societies and associations represent, and are strong advocates for, their members and, thus, may not be completely objective on issues which may affect those members. In my opinion, professional associations and societies represent a potentially highly useful resource for departments and agencies in need of advice representing the best thinking in a particular field. However, such organizations will need to be particularly assiduous in assuring that their advice is free of bias and self-interest.

THE NATIONAL ACADEMIES: THEIR FUTURE ROLES

The national academies were established specifically to overcome the inherent limitations of the other mechanisms to which the Federal Government can turn for scientific and technological advice. It is intended that: one, each academy comprise the most distinguished individuals in the disciplines and areas represented by that academy; and two, each academy represent, to the executive branch, an intellectual resource capable of providing highly competent and objective advice in that area.

As I stated in my introductory comments above, it is my perception that the National Academies of Sciences and Engineering have, overall, done an excellent job of living up to these expectations, but that the Institute of Medicine has yet to attain its full potential. In the next paragraphs, I would like to address a number of issues pertaining to the ability of the academies to meet the critical advisory roles I perceive they must fill in the future.

TIMELINESS AND COST

Two issues which continue to give agencies second thoughts when they consider the academies as sources of external expert advice are the cost and timeliness of that advice. Because of the size and complexity of the academy complex, the need to maintain an ongoing infrastructure capable of responding to agency requests, and the dependence of the academies on discrete project studies requested and funded by Federal agencies, the academies are expensive organizations with which to do business. As their size and complexity have grown, so too, have their indirect costs. Although I am aware of the efforts by Dr. Press and his colleagues to constrain these costs, it is clear that cost-containment must continue to be an important priority.

An even greater problem relates to the timeliness of Academy studies. Before the current academy presidents took office, academy projects seemed to require a distressingly long time to complete and reports were seldom delivered on schedule. For this reason, departments and agencies dealing with rapidly moving policy issues found the academies increasingly unable to provide advice in a timely manner. I know that, since taking office, Dr. Press has made a special effort to reduce the period required for academy studies, to meet agreed-upon deadlines, and to report to sponsors on a timely basis. I applaud these efforts and hope that all three academies will continue their efforts to find ways to mobilize their intellectual resources in a timely way. This will likely be accomplished by implementing procedures to expedite academy study and review procedures, and by exploring a number of rapid response advisory mechanisms somewhat short of the full-blown committee study approach now employed in most instances.

QUALITY

Not all studies conducted by the three academies are of the quality one would expect from organizations with such prestigious members. The reasons for this uneveness are several. First, the members and other distinguished individuals involved in academy studies are part-timers, able to spend only a small portion of their professional lives on a particular academy study or report. Accordingly, the quality of academy studies and reports is highly dependent on the quality of the staff members responsible for them. Because of the almost contract research nature of the academies, recruiting and retaining high-quality staff is a chronic problem.

The second problem relates to the nature of many of the difficult and complex problems with which the academies are concerned. It is a fact of life that the public policy process within which decisions about scientific and technological issues are considered and made is often not consistent with the process employed by the academies in studying and analyzing those same issues. The public process moves very quickly, integrates a variety of perspectives only some of which are scientific and technological in nature, and prefers definitive analyses and black or white policy choices. In contrast, the process employed by the academies is inherently more lengthy, studied, and academic, providing an opportunity for all legitimate positions and opinions to be heard and considered. Because the topics being considered by the academies often resist simplistic, black or white analyses and recommendations, final reports of academy studies are often the result of a considerable amount of compromise among strongly differing views. This process of consensus-building and compromise often results in a report deemed less than ideal to policymakers faced with discrete public policy decisions. In addition, that process often weakens the report to the point that its overall quality and usefulness are suspect.

OBJECTIVITY AND INDEPENDENCE

The final point I wish to address has to do with my strong feeling that every effort must be made to protect the independence and objectivity of the academies. If that objectivity and independence is, in any way, compromised, the whole academy concept must be opened to reexamination. More specifically, I personally am concerned about the tendency of the last several years for the three academies to become "job shops," competing with all the other contract research organizations in Washington for Federal agency dollars for specific policy studies. It seems clear to me that, as long as the academies are so highly dependent upon the Federal Government for their survival and sustenance, on a project-to-project basis, their objectivity and independence will always be in jeopardy. That is particularly true in instances here the academy is dealing with a politically charged topic where the administration has taken a strong position with which the academy may ultimately have to disagree. It is difficult to be totally objective and unbiased when the source on which you are completely dependent for your survival strongly prefers a study outcome consistent with the stand it has already taken. That is, one tends not to bite the hand from which it feeds.

And yet, it is exactly in these instances that this country needs an absolutely autonomous academy structure. As the scientific and technological issues with which we must deal become increasingly complex and politically charged, it is critical that we as a nation have at our disposal a completely independent mechanism capable of providing the best possible scientific and technological advice. One need only to read the papers these days to understand the kinds of issues for which such a mechanism is critical. Examples include: the environmental effects of acid precipitation; the validity of reports of chemical warfare—yellow rain—in Southeast Asia; the technical feasibility of a space-based missile defense system; and the short- and long-term health effects of defoliants such a Agent Orange. In each of these cases, primarily for political reasons, the administration has taken a rather strong stand which, many feel, is not supported by scientific fact. In such cases, we must be able to turn to a strong, independent Academy complex for an objective analysis of the data available.

One answer to this dilemma lies in the ability of the academies to build an endowment upon which they can draw to support studies on controversial topics. Were such an endowment available, academy presidents could initiate such studies without the need to approach Federal agencies for financial support. Dr. Press and his colleagues are actively pursuing the development of internal funding sources for these purposes and are already using funds collected to support academy-initiated projects. I am a strong advocate of this effort and recommend that the Congress consider alternative approaches to helping the academies achieve this end. One possibility would be a one-time congressional appropriation to the academies for the purpose of aiding in the establishment of an endowment adequate to assure their independence and autonomy. This could be done on a matching basis to encourage and reward private sector contributions.

I wish to thank the chairman and the members of the task force for inviting me to present my views on this important public policy issue. I will be pleased to answer any questions you may wish to ask.

[The prepared statement of Dr. Prager follows:]

TESTIMONY OF DR. DENIS J. PRAGER
DEPUTY DIRECTOR, HEALTH PROGRAM
JOHN D. AND CATHERINE T. MACARTHUR FOUNDATION
****
SCIENCE POLICY TASK FORCE
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

Mr. Chairman and members of the Task Force, I am Dr. Denis J. Prager, a senior program officer of the MacArthur Foundation in Chicago. Immediately before joining the Foundation, I spent six months at the National Academy of Sciences, establishing the then new Government-University-Industry Research Roundtable. Prior to that, I was, for five years, a member of the staff of the White House Office of Science and Technology Policy where I was responsible for the development and implementation of policies primarily in the areas of health and agricultural research and regulatory science. It is from this perspective that I would like to address the topic of this hearing -- the role of the National Academies in providing scientific, technical, and policy advice to the Federal Government.

First, I would like to take this opportunity to congratulate the Chairman, the members of the Task Force, and the members of the Committee for their foresight in perceiving the need for a broad-ranging study of American science policy and for their perseverance in pursuing its ambitious goals. In my opinion, this comprehensive review comes at a critical time in the evolution of American science and technology. We are entering a time of unprecedented intellectual ferment in science when we can anticipate extraordinary advances in our knowledge of the natural world in which we live and in our ability to apply that knowledge to improving the well-being of the American people as well as other citizens of this planet. At the same time: (1) there are serious questions being raised about the adequacy of the university infrastructure on which we depend for the conduct of basic research; (2) there are severe pressures to reduce the tremendous Federal deficit which threatens the economic viability of this nation; (3) serious concern is being expressed about the social consequences of scientific and technological advances; and (4) there is growing pressure to focus an ever larger proportion of the science budget on research which directly supports military or industrial competitiveness objectives.

In light of these growing economic and social pressures and concerns and the difficult public policy decisions they imply for the Congress and the President, it seems clear that there will be an ever increasing need for independent, objective, and timely scientific and technical advice on: opportunities in science and technology; priorities in the allocation of scarce resources; problems and needs in the science and technology enterprise; and the intended and unintended consequences of scientific advances and their technological applications.

In these brief remarks, I wish to address the roles of the National Academies in providing such advice, focusing particularly on their future roles and on the need to protect their independence as they attempt to fulfill them.

PAST PERFORMANCE

The National Academy of Sciences (NAS) has a long and distinguished history of responding to Congressional and Executive Branch requests for competent and timely advice on scientific and technological issues confronting the country. Because the NAS has access to the best minds in a broad range of scientific disciplines and areas of expertise, it is able to mobilize the expertise required to provide advice on an extensive array of issues. It is my perception that the NAS is still perceived as this country's preeminent source of objective scientific advice. It is also my perception, that the National Academy of Engineering has, in only two decades, established itself as a highly credible source of information and advice on the kinds of technological issues of increasing interest and concern to the people of this country and their appointed and elected representatives.

However, in my opinion, the newest member of the National Academies, the Institute of Medicine (IOM), has yet to meet the expectations which many of us in the health and biomedical sciences have for it. For a number of reasons related to the breadth of its mandate and the diversity of its membership, scarcity of resources, inadequacy of professional staff and leadership, and its relationship to the NAS, the IOM has not as yet established itself as the premier source of advice on the tremendous range of health, medical, and biomedical sciences issues facing the country at this time. In this regard, I am personally most pleased and heartened that Dr. Samuel O. Thier has recently assumed the presidency of the IOM. Under Dr. Thier's capable and energetic leadership, I am optimistic that the IOM will address the several substantial institutional issues to which I have briefly alluded and will, accordingly, improve the quality and timeliness of its studies and reports.

SCIENCE AND TECHNOLOGY ADVICE: NEEDS AND SOURCES

The Need For Advice

As I stated in my introductory remarks, there seems little doubt that the elected and appointed leaders of this country will increasingly be faced with extremely difficult and politically charged choices and decisions concerning scientific and technological priorities and the allocation of scarce resources to pursuing those priorities. And, even as the number and difficulty of those decisions grow, so will the sophistication and complexity of the science and technology about which they are concerned. As we delve deeper into the molecular and atomic structure and function of nature, so, too, do we increasingly limit the number of people capable of understanding that structure and function, the nature and importance of the research being conducted, and the potential applications and unintended side-effects of the new knowledge being discovered. For that reason, those responsible for guiding this country in the future will have an ever growing need for objective and timely advice on which to base hard choices and difficult decisions.

Sources of Advice

The President and his Executive Branch, Department and Agencies have at their disposal, a broad array of potential sources of scientific and technical advice. These include: (1) internal offices and committees established to advise agency leadership on difficult scientific and technological issues; (2) external councils, panels, committees, and boards established by agencies as means for obtaining on-going advice from outside experts; (3) professional associations and societies; and (4) the National Academies.

Let me briefly explore the advantages and disadvantages of each one of these mechanisms.

Internal Agency Mechanisms. In my opinion, internal agency offices, committees, and other mechanisms comprised of full-time agency employees are not, by themselves, adequate sources of objective and competent advice on the increasingly complex scientific and technological issues facing most Federal departments and agencies. These offices are chronically plagued by inadequate financial and staff resources, by difficulty in recruiting and retaining highly qualified, full-time scientists and engineers, and by the inherent "captive," and non-independent nature of the advice which such mechanisms represent.

Perhaps, the most prominent and visible example of the problems associated with such internal advisory mechanisms is the Office of Science and Technology Policy (OSTP), established by the Congress to advise the President on scientific and technological issues facing the country and on the management of the Federal science and technology establishment. All of the limitations and difficulties mentioned above apply in spades to OSTP. Financial resources and staff positions are chronically limited by OMB and, for this reason, the staff comprises a mixed bag of individuals detailed from various Executive Branch departments and agencies. However, the greatest challenge facing OSTP is the degree to which it can maintain its position as a source of highly competent, objective advice in the highly charged maelstrom of the Executive Office of the President. An OSTP Director sensitive to this challenge and committed to protecting the objectivity of the Office, is constantly caught in the conflict of trying to be an objective advisor while still being perceived by his Executive Office colleagues as a "team player." The success of the Office as a true, objective advisory mechanism depends, to a large degree on the ability of the Director to survive in this tense and ambiguous context. Since I served under two OSTP Directors in two, quite different administrations, perhaps my perspective might be helpful.

Under the Carter Administration, the OSTP Director and Science Advisor, Dr. Frank Press, strived particularly hard to protect the objectivity of the Office. It is my perception that Dr. Press attempted, in all cases of which I am aware, to provide the President with the best scientific and technical advice he could muster, regardless of its political consequences. He understood, I believe, that there were many others on the White House staff whose primary concern was providing political advice to the President, and that his role on the team was to provide competent, timely, and objective scientific and technical advice. It is my perception, also, that Dr. Press was highly successful in this regard although, in many cases, it drew the ire of many of his White House colleagues.

In sharp contrast, is the Office of Science and Technology Policy under the Reagan administration. Dr. George A. Keyworth, II who, until recently, was the Director of OSTP and Science Advisor, came into the Office committed to maintaining his objectivity and providing his best advice to the President free of political or ideological bias. However, in a relatively short time, Dr. Keyworth became a strong partisan and outspoken political advocate, eschewing objectivity and embracing a number of Presidential political positions to which he was previously unalterably opposed (including, foremost, strong opposition to the Strategic Defense Initiative). It is my opinion, that, under this Administration, OSTP has become a highly politicized office dedicated primarily to furthering the President's goals and programs in defense, space, and industrial competitiveness. The one formal external advisory mechanism -- the White House Science Council -- which many hoped would fill the role of providing objective advice to the President, suffers from similar limitations. Since, instead of reporting to the President, it advises the Science Advisor, himself, the Council can be, and has been, shaped and manipulated by the OSTP Director to serve the political purposes of the Administration.

While not wishing to dwell on this particular example, I think it does illustrate the inherent limitations of such internal advisory mechanisms and sharpens the need for independent external advice.

External Advisory Committees. Most Federal departments and agencies dealing with the support and/or conduct of scientific research and technical development utilize a range of committees, panels, and boards to provide advice on everything from questions of agency directions and priorities to the evaluation of individual research proposals and agency programs. In general, it can be said that, the more an advisory committee is concerned with providing advice on the scientific merit and relevance or technical adequacy of specific research proposals or programs, the more objective and independent the advice. For, in most cases, these peer-review panels are comprised of scientists and engineers selected only on the basis of their experience and expertise in relevant scientific and technical areas. However, the more agency advisory committees deal with agency policies and priorities, the more such panels are vulnerable to political manipulation. In fact, in many cases, the members of such policy committees and boards are appointed by the agency head or the President on the basis of selection criteria which vary from administration-to-administration and agency head-to-agency head. For example, in this Administration, every effort has been made to assure that individuals appointed to agency and department policy boards have a political ideology consistent with that of the President. Although it is not unreasonable to expect Presidential appointees to reflect his beliefs, fealty to the President should not be the sole or even the predominant selection criterion for members of panels established to advise on scientific and technical policy issues.

Professional Societies and Associations. There are literally thousands of associations and societies representing the interests of scientists and engineers, generally, or of disciplines or areas of interest, specifically. To the degree that such organizations are capable of mobilizing the kind of expertise required to address important scientific or technological questions at a technical or policy level, they represent a potentially important resource for Executive Branch departments and agencies grappling with those issues. However, it is widely perceived by the leadership of those departments and agencies that most societies and associations represent, and are strong advocates for, their members and, thus, may not be completely objective on issues which may affect those members. In my opinion, professional associations and socities represent a potentially highly useful resource for departments and agencies in need of advice representing the best thinking in a particular field. However, such organizations will need to be particularly assiduous in assuring that their advice is free of bias and self-interest.

THE NATIONAL ACADEMIES: FUTURE ROLES

The National Academies were established specifically to overcome the inherent limitations of the other mechanisms to which the Federal government can turn for scientific and technological advice. It is intended that: (1) each Academy comprise the most distinguished individuals in the disciplines and areas represented by that Academy; and (2) each Academy represent, to the Executive Branch, an intellectual resource capable of providing highly competent and objective advice in that area. As I stated in my introductory comments above, it is my perception that the National Academies of Sciences and Engineering have, overall, done an excellent job of living up to these expectations, but that the Institute of Medicine has yet to attain its full potential. In the next paragraphs, I would like to address a number of issues pertaining to the ability of the Academies to meet the critical advisory roles I perceive they must fill in the future.

Timeliness and Cost. Two issues which continue to give agencies second thoughts when they consider the Academies as sources of external expert advice are the cost and timeliness of that advice. Because of the size and complexity of the Academy complex, the need to maintain an ongoing infrastructure capable of responding to agency requests, and the dependence of the Academies on discrete project-studies requested and funded by Federal agencies, the Academies are expensive organizations with which to do business. As their size and complexity have grown, so have their indirect costs. Although I am aware of the efforts by Dr. Press and his colleagues to constrain these costs, it is clear that cost-containment must continue to be an important priority.

An even greater problem relates to the timeliness of Academy studies. Before the current Academy Presidents took office, Academy projects seemed to require a distressingly long time to complete and reports were seldom delivered on schedule. For this reason, departments and agencies dealing with rapidly moving policy issues found the Academies increasingly unable to provide advice in a timely manner. I know that, since taking office, Dr. Press has made a special effort to reduce the period required for Academy studies, to meet agreed-upon deadlines, and to report to sponsors on a timely basis. I applaud these efforts and hope that all three Academies will continue their efforts to find ways to mobilize their intellectual resources in a timely way. This will likely be accomplished by implementing procedures to expedite Academy study and review procedures and by exploring a number of rapid-response advisory mechanisms somewhat short of the full-blown committee-study approach now employed in most instances.

Quality. Not all studies conducted by the three Academies are of the quality one would expect from organizations with such prestigious members. The reasons for this unevenness are several. First, the members and other distinguished individuals involved in Academy studies are "part-timers" able to spend only a small portion of their professional lives on a particular Academy study or report. Accordingly, the quality of Academy studies and reports is highly dependent on the quality of the staff members responsible for them. Because of the almost contract research nature of the Academies, recruiting and retaining high quality staff is a chronic problem.

The second problem relates to the nature of many of the difficult and complex problems with which the Academies are concerned. It is a fact of life that the public policy process within which decisions about scientific and technological issues are considered and made is often not consistent with the process employed by the Academies in studying and analyzing those same issues. The public policy process moves very quickly, integrates a variety of perspectives only some of which are scientific or technical in nature, and prefers definitive analyses and black or white policy choices. In contrast, the process employed by the Academies is inherently more lengthly, studied, and academic, providing an opportunity for all legitimate positions and opinions to be heard and considered. Because the topics being considered by the Academies often resist simplistic, black or white analyses and recommendations, final reports of Academy studies are often the result of a considerable amount of compromise among strongly differing views. This process of consensus-building and compromise often results in a report deemed less than ideal to policymakers faced with discrete public policy decisions. In addition, that process often weakens the report to the point that its overall quality and usefulness are suspect.

Objectivity and Independence. The final point I wish to address has to do with my strong feeling that every effort must be made to protect the independence and objectivity of the Academies. If that objectivity and independence is, in any way, compromised, the whole Academy concept must be opened to re-examination. More specifically, I personally am concerned about the tendency over the last several years for the three Academies to become "job shops" competing with all the other contract research organizations in Washington for Federal agency dollars for specific policy studies. It seems clear to me that, as long as the Academies are so highly dependent upon the Federal government for their survival and sustenance, on a project to project basis, their objectivity and independence will always be in jeopardy. That is particularly true in instances where an Academy is dealing with a politically charged topic where the Administration has taken a strong position with which the Academy may ultimately have to disagree. It is difficult to be totally objective and unbiased when the source on which you are completely dependent for your survival strongly prefers a study outcome consistent with the stand it has already taken. That is, one tends not to bite the hand from which it feeds.

And yet, it is exactly in these instances that this country needs an absolutely autonomous Academy structure. As the scientific and technological issues with which we must deal become increasingly complex and politically charged, it is critical that we as a nation have at our disposal a completely independent mechanism capable of providing the best possible scientific and technological advice. One need only read the papers these days to understand the kinds of issues for which such a mechanism is critical. Examples include: the environmental effects of acid precipitation; the validity of reports of chemical warfare (yellow rain) in Southeast Asia; the technical feasibility of a space-based missile defense system; and the short- and long-term health effects of defoliants such as Agent Orange. In each of these cases, primarily for political reasons, the Administration has taken a rather strong stand which, many feel, is not supported by scientific fact. In such cases, we must be able to turn to a strong, independent Academy complex for an objective analysis of the data available.

One answer to this dilemma lies in the ability of the Academies to build an endowment upon which they can draw to support studies on controversial topics. Were such an endowment available, Academy Presidents could initiate such studies without the need to approach Federal agencies for financial support. Dr. Press and his colleagues are actively pursuing the development of such internal funding sources for just such purposes and are already using funds collected to support Academy-initiated projects. I am a strong advocate of this effort and recommend that the Congress consider alternative approaches to helping the Academies achieve this end. One possibility would be a one-time Congressional appropriation to the Academies for the purpose of aiding in the establishment of an endowment adequate to assure their independence and autonomy. This could be done on a matching basis to encourage and reward private-sector contributions.

I wish to thank the Chairman and the members of the Task Force for inviting me to present my views on this important public policy issue. I will be pleased to answer any questions you may wish to ask.

DISCUSSION

Mr. **Brown**. Thank you very much, Dr. Prager.

Your last recommendation was the sort of specific recommendation that I had hoped to elicit from the academy presidents. I raised the question of endowment without having read your testimony. I am delighted, of course, that you feel that it might have a significant role in helping to achieve that independence and autonomy. Do you have any ideas about what the magnitude of such a one-time appropriation might be?

Dr. **Prager**. That is a little difficult. My sense is that probably the three academies would need in the order of $100 million total of endowment to be able to have enough each year to draw upon. That is really off the top of my head. I know Dr. Thier has talked about something in the order of $20 million for the Institute of Medicine.

I don't think the Congress should necessarily, pick up all, or even a substantial portion of it. However, a reasonable contribution would be a very good idea. A matching contribution perhaps, that would encourage foundations, industry and others, and individuals, to contribute too. I know that a number of foundations, including the one I work for, which are involved with health, are considering the possibility of coming together as a consortium to raise money for the Institute of Medicine in order to give it that kind of independence.

I feel that the cost, timeliness and quality of the studies and quality of the staff, as well as the objectivity, independence, and autonomy, we seek for the academies would all benefit were the academy presidents able to draw upon independent funds.

Mr. **Brown**. Of course, Dr. Prager, this doesn't solve the problem of relating this advice to the operational needs of the Federal Government. It is quite conceivable that the Federal Government faced with independent, autonomous objectives, scientific advice, that it didn't want, would not use it and wouldn't solicit it even if it was free. You haven't, therefore, accomplished a great deal more.

Dr. Keyworth, despite the comments that you made, at least had the advantage of having a president who solicited his advice and who used it, because it did conform to his own views, and other presidents not only didn't use the Office of the Science Advisor but sought to eliminate it. The balance there is one that is very difficult to achieve.

Your own comments might be construed as sort of harsh, but I think obviously based on your experiences, there is a high degree of validity to them, and we see that same phenomenon operating in a wide range of similar situations. I am intrigued by the fact that instead of going to the academy for advice on SDI, the President appointed a commission headed by a distinguished scientist who gave him the kind of advice that he wanted, which is an interesting phenomenon.

Recently, it has come to my attention also that we have had a little flap going on for a number of years about the interpretation of seismological data related to nuclear underground blasts, and that in spite of repeated scientific recommendations with regard to that, there were certain people in the administration who had difficulty changing the parameters that they were using to evaluate these blasts because they liked the idea of having the figures come out above the limit on the Limited Nuclear Test Ban Treaty. I am deeply concerned about the institutional mechanisms by which we intend to alleviate these kinds of problems and achieve what you might call a higher quality of both production and utilization of the best available information.

It seems to me—I want to ask your comment on this—for the academy to be most productive, it has to have a concomitant understanding of the political process and of the way value systems enter into the demand for objective scientific information, and it may be that the very concept of the academy or the structure needs to be broadened to put the greatest emphasis upon some connective mechanism which incorporates this understanding of the political process. Has that type of thing occurred to you at all.

Dr. PRAGER. Not really, because it seems to me that, since the academies are not governmental but are at least quasiindependent, even though they are chartered by Congress, their naivete about the political process might be an advantage as long as Dr. Press and his colleagues continue their efforts to get the results of their studies into the public sector.

It is certainly true, that were the academies to come out with—as they have in some cases—very strong statements about acid rain and agent orange, and other issues which do not agree with positions taken by the administration, the President's science adviser, and the White House Executive Office, could choose to ignore those statements.

The academies can make those reports public, the newspapers can deal with them, and congressional committees can invite witnesses from the academies and from those study committees to come up and try to make sure that a balanced view is heard. I don't know any other way to do that. You can't force a President to listen to an opinion he doesn't want to hear.

Mr. BROWN. I am not suggesting that. I think you have addressed, you have answered the question adequately. The connective we have here is the political process and to have that information flow into the proper channels so that the forces which govern political action are changed by the institution of information is the most effective connective sometimes. Congressmen are notorious for changing their views when the constituency that they represent, as a result of greater enlightenment, adopt a different position, and one function of the academy might be to seek ways in which they can, through the educational process, the media process, have this impact upon the awareness of the public.

Dr. PRAGER. The only thing I think that, they have to be careful about is that, no matter how much endowment you give them, they are, and should be, dependent upon the Federal agencies and the Congress for individual projects. That continues to be a major source of support and a major role that they serve, which is to respond to the requests by the agencies and the Congress for specific kinds of studies. The academies wouldn't want to make the executive branch too mad by going out and actually lobbying against an administration position, so there is a fine line between making the information public and actually trying to advocate a position that the Academy has come to.

In fact, in the beginning of this administration, when Dr. Keyworth came into office and some of the first budget recommendations were made by this administration about scientific research, Dr. Press called together a forum of scientists and engineers at the National Academy of Sciences to talk about the potential implications of reductions in research funding in a number of areas, including the social and behavioral sciences. Dr. Keyworth and members of OMB and others were invited to speak. Following that forum, there was a feeling around the White House that the forum was a set up and Dr. Keyworth, himself, was extremely angry at Dr. Press for a very long time.

As a result there were discussions to which I was privy, particularly among some OMB people, about putting out a directive to the Federal departments and agencies saying, "Thou shall not use the National Academy of Sciences for studies. They are not objective, they called people together to oppose our views, and for that reason, we shouldn't use them." That never was done, but it was discussed.

Still, early on, administration people were feeling their oats and thinking they could do that kind of thing. Fortunately, I think Jay and others prevailed and that didn't occur. But, there was an anger in the beginning that even bringing people together to talk about these issues was an attack. So, I think there is always going to be a fine line between providing information to the political process and trying to influence it.

Mr. BROWN. That is a fine line. You should sit in some of the OTA board meetings sometimes and see how fine it is.

Dr. PRAGER. I can imagine.

Mr. BROWN. Dr. Prager, much as I would like to keep you here for an additional period of time, I think we will defer additional questions. We appreciate the value of your input and hope we can continue to communicate with you about these matters. You have made a valuable contribution to our examination of the academies and their role, and we appreciate it very much.

Dr. PRAGER. Thank you It has been a pleasure to be here.

Mr. BROWN. The task force will be adjourned.

[Whereupon, at 11:45 a.m., the task force adjourned to reconvene on Wednesday, May 14, 1986 at 10 a.m.]

APPENDIX 1

A CHRONICLE OF PUBLIC LAWS

Calling for Action
by the

NATIONAL ACADEMY OF SCIENCES
NATIONAL ACADEMY OF ENGINEERING
INSTITUTE OF MEDICINE
NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY PRESS
WASHINGTON, D.C.
1985

Preface

In 1863, Congress enacted legislation to establish the National Academy of Sciences. The Academy's purpose was to serve as a unique institution to advise the federal government on "any subject of science or art." Today, the Academy and its associated organizations—the National Academy of Engineering and the Institute of Medicine—work through the National Research Council to examine scientific and technological questions of national importance. Typically, these questions are referred to them by the Administration and the Congress.

This book contains recent legislation passed by Congress calling upon the Academy and its associated organizations to perform certain tasks. It has been prepared not only as a guide for those engaged in drafting legislation to initiate congressionally authorized studies but also as a record of such statutory enactments. The volume does not purport to contain all of the pertinent federal laws and actions—that would entail going back to the 1870's—although it does include the act of incorporation and its amendments as well as relevant executive orders. Instead, the book concentrates on the major legislation passed from the 86th through the 98th Congresses (1959–1984).

Traditionally, much of the Academy's work has been undertaken in response to requests initiated by federal agencies rather than by Congress. Since the early 1970's, Congress has been turning with increasing frequency to the Academy for objective counsel by commissioning studies through specific legislation. While they represent only a small percentage of the total number of studies undertaken by the Academies and the Institute on behalf of the federal government, those authorized through congressional initiatives address some of the more significant public policy issues related to science and technology. On several occasions, the Academy also has contracted directly with committees of the Congress to perform studies on their behalf.

As the nation's policy agenda has changed in recent decades, so have the topics to be investigated. In addition to such considerations as fostering the health of the nation's scientific enterprise, strengthening national security, and supporting space science, the current agenda of inquiries has been broadened to include environmental problems, social issues, international concerns, and technological challenges. Nevertheless, the same mechanisms have continued to shape the process of congressionally authorized studies.

The method employed by Congress to initiate studies involves statutory enactments which direct cabinet officers or agency heads to enter into contractual or grant arrangements with the Academy. The Academy, although a national organization chartered by Congress, is not a governmental agency and receives no direct federal appropriations for its work. Studies undertaken for the government by the constituent units of the Academy usually are funded out of appropriations made available to federal agencies. Whatever the arrangement, the Academy retains the authority to make independent selection and appointment of the members of its study committees and to carry out studies under its own operating procedures and rules. This independence also means that the Academy assumes full responsibility for assuring the objectivity of its studies and reports. Upon completion, reports often are transmitted simultaneously to Congress and to the relevant agency.

Besides performing studies, the Academy and its associated organizations give advisory support to Congress in a number of other ways. Among them are providing expert witnesses for congressional hearings, arranging briefings on significant policy reports for members of Congress and their staffs, organizing seminars on major policy subjects to which members and their staffs are invited, and supplying members with copies of reports.

The significance of the National Research Council's service to the nation has been acknowledged by an Executive Order of the President calling upon the Academy to perpetuate the Council's role. The distinguished record of the Research Council is traceable not only to the breadth of its tasks but also to the manner of its operation.

The work of the National Research Council is carried out by volunteer committees whose members are selected for their expertise in the scientific and technical areas under study. The capacity to draw upon the resources of the nation's scientific and technical community is one of the Research Council's greatest assets. Each year, upward of 8,500 scientists, engineers, and other professionals contribute their experience and advice toward the solution of national problems through service on some 800 Research Council committees. These individuals are drawn from every part of the country and from every sector—academia, government, industry, commerce, nonprofit organizations, and public interest groups—and they donate their services without charge to the benefit of the nation.

Frank Press,
President,
National Academy of Sciences

Contents

PREFACE iii

GENERAL INFORMATION xi
- National Academy of Sciences xi
- National Academy of Engineering xii
- Institute of Medicine xii
- National Research Council xiii
- Committee on Science, Engineering, and Public Policy xiii
- Government–University–Industry Research Roundtable xiii

ORGANIZATIONAL DIAGRAM xiv

NOTES xv

EXCERPTS OF LEGISLATION

GENERAL

37th Congress, Session 3, Chapter 111:	An Act to Incorporate the National Academy of Sciences (Includes amendments in 41st Congress, Session 2, Chapter 264; 48th Congress, Session 1, Chapter 107; and Public Law 109, 63rd Congress, Session 2, Chapter 101)	3
Executive Order No. 2859:	Perpetuation of the National Research Council (Includes amendment in Executive Order No. 10668)	7
P. L. 86–209:	An Act to Establish a National Medal of Science	9
Executive Order No. 11287:	Committee Membership and Recommendations for the National Medal of Science	10
P. L. 90–407:	National Science Foundation Act of 1950, Amendments (National Science Board)	12
P. L. 95–625:	National Parks and Recreation Act of 1978 (Albert Einstein Memorial)	14
P. L. 96–526:	Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1981 (Postperformance Evaluation of Scientific Research)	16

AGRICULTURE AND FOOD

P. L. 86–618: Color Additive Amendments of 1960 21

P. L. 95–113: National Agricultural Research, Extension, and Teaching Policy Act of 1977 (Title XIV of the Food and Agriculture Act of 1977) (Solar Energy Research Information System) 23

P. L. 95–203: Saccharin Study and Labeling Act 25

P. L. 95–448: Agriculture, Rural Development, and Related Agencies Appropriations, Fiscal Year 1979 (Antibiotics in Animal Feed and Cotton Dust Standards) 28

P. L. 96–108: Agriculture, Rural Development and Related Agencies Appropriation, 1980 (Antibiotics in Animal Feed) 32

AIR AND WATER POLLUTION

P. L. 91–604: Clean Air Amendments of 1970 (Motor Vehicle Emission Standards) 37

P. L. 92–500: Federal Water Pollution Control Act Amendments of 1972 (Effluent Limitations) 41

P. L. 93–523: Safe Drinking Water Act (National Drinking Water Regulations) (Includes amendments in P. L. 95–190) 44

P. L. 95–95: Clean Air Act Amendments of 1977 (Air Quality Standards) 49

P. L. 96–294: Energy Security Act (Carbon Dioxide Study) 55

(*See also* P. L. 98–466 under *TRANSPORTATION—AIR*)

BUILDING SCIENCE AND TECHNOLOGY

P. L. 93–383: Housing and Community Development Act of 1974 (National Institute of Building Sciences) 61

ENVIRONMENTAL HEALTH

P. L. 86–373: Atomic Energy Act of 1954, Amendments (Federal Radiation Council) 67

P. L. 94–317: Disease Control Amendments of 1976 (Title II of the National Consumer Health Information and Health Promotion Act of 1976) (Lead-Based Paint Poisoning) 69

P. L. 95–622: Biomedical Research and Research Training Amendments of 1978 (Title II of the Community Mental Health Centers Act, Amendments) (Low–Level Ionizing Radiation) 71

P. L. 95–623: Health Services Research, Health Statistics, and Health Care Technology Act of 1978 (Study of Costs of Environment–Related Diseases) 74

P. L. 96–205: United States Insular Areas Appropriation Authorization (Radiation Exposure Compensation, Marshall Islands) 77

P. L. 96–528: Agriculture, Rural Development, and Related Agencies Appropriations, Fiscal Year 1980 (Risk Assessment) 80

P. L. 97–35: Consumer Product Safety Amendments of 1981—Subtitle A of Title XII of the Omnibus Budget Reconciliation Act of 1981 (Chronic Hazard Advisory Panel) 82

(*See also* the section on *AIR AND WATER POLLUTION* and P. L. 95–448 under *AGRICULTURE AND FOOD*)

ENVIRONMENTAL PROTECTION

P. L. 91–441: Armed Forces Appropriation Authorization, 1971 (Herbicides and Defoliation Study) 87

P. L. 92–516: Federal Environmental Pesticide Control Act of 1972 (Public Hearings and Scientific Review) 89

P. L. 93–135: Agriculture-Environmental and Consumer Protection Appropriation Act (Study of Environmental Protection Agency Programs) 93

P. L. 95–477: Environmental Research, Development, and Demonstration Authorization Act of 1979 97

P. L. 96–229: Environmental Research, Development, and Demonstration Authorization Act of 1980 (Non–nuclear Hazardous Waste Disposal Study) 99

(*See also* P. L. 95–87 under *LAND AND RESOURCE MANAGEMENT*)

HEALTH CARE DELIVERY

P. L. 93–112: Rehabilitation Act of 1973 (Rehabilitation Services Administration) 103

P. L. 93–154: Emergency Medical Services Systems Act of 1973 (Interagency Committee on Emergency Medical Services) (Includes amendment in P. L. 94–573) 105

P. L. 93–222: Health Maintenance Organization Act of 1973 (Health Care Quality Assurance Programs Study) 107

P. L. 95–83: Health Planning and Health Services Research and Statistics Extension Act of 1977 (International Health Activities Study) 110

P. L. 98–551: Health Promotion and Disease Prevention Amendments of 1984 (Council on Health Care Technology) 112

HEALTH MANPOWER

P. L. 93–82: Veterans Health Care Expansion Act of 1973 (Veterans' Administration Personnel Requirements) 117

P. L. 93–233: Social Security Amendments of 1973 (Physicians' Services in Teaching Hospitals) 119

P. L. 93–348: National Research Service Award Act of 1974 (Title I of the National Research Act) (Biomedical and Behavioral Research Personnel) (Includes amendments in P. L. 94–278 and P. L. 95–622) 121

P. L. 96–76: Nursing Training Amendments of 1979 (Title I of the Public Health Service Act, Amendment) (Nursing Study) 124

P. L. 97–35: Omnibus Budget Reconciliation Act of 1981 (Physician Study) 127

HEALTH RESEARCH

P. L. 94–562: Arthritis, Diabetes, and Digestive Disease Amendments of 1976 (Digestive Diseases Coordinating Committee) 131

P. L. 96–538: Health Programs Extension Act of 1980 (Neurological Research) 133

P. L. 98–63: Supplemental Appropriations Act, 1983 (Trauma Research) 135

P. L. 98–78: Department of Transportation and Related Agencies Appropriations Act, 1983 (Appropriation for Trauma Research) 137

P. L. 98–460: Social Security Disability Benefits Reform Act of 1984 (Evaluation of Pain) 139

LAND AND RESOURCE MANAGEMENT

P. L. 93–251: Water Resources Development Act of 1974 (Washington Metropolitan Area Water Resource Needs Study) 145

P. L. 95–87: Surface Mining Control and Reclamation Act of 1977 (Includes amendment in P. L. 95–617) 148

P. L. 95–514: Public Rangelands Improvement Act of 1978 (Wild Horses and Burros) 153

P. L. 97–341: Capitol Reef National Park, Grazing Phaseout Study 155

P. L. 98–409: State Mining and Mineral Resources Research Institute Program 157

P. L. 98–425: California Wilderness Act of 1984 (Mono Basin National Forest Scenic Area) 160

P. L. 98–473: Department of the Interior and Related Agencies Appropriations Act, 1985 (Wild Horse and Burro Levels) 162

(*See also* P. L. 92–522 under *MARINE SCIENCES*)

MARINE SCIENCES

P. L. 92–522: Marine Mammal Protection Act of 1972 (Includes amendment in P. L. 98–364) 167

P. L. 96–516: National Science Foundation Authorization and Science and Technology Equal Opportunities Act (Ocean Margin Drilling Project) 170

PHYSICS

P. L. 98–371: Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1985 (Review of Research on Underwater Neutrinos) 175

SPACE SCIENCES

P. L. 97–12: Supplemental Appropriations and Rescission Act, 1981 (Review of International Solar Polar Mission) 179

P. L. 98–52: National Aeronautics and Space Administration Authorization Act, 1984 (Study of Sun–Earth Interactions) 181

TRANSPORTATION—AIR

P. L. 97–369: Department of Transportation and Related Agencies Appropriations Act, 1983 (Wind Shear Study) 187

P. L. 98–466: An Act to Determine the Adequacy of Certain Industry Practices and Federal Aviation Administration Rules and Regulations (Air Cabin Air Quality Study) 189

TRANSPORTATION—LAND

P. L. 95–599: Highway Safety Act of 1978 (Title II of the Surface Transportation Assistance Act of 1978) (Safety Belt Study) 195

P. L. 97–261: Bus Regulatory Reform Act of 1982 (Study of Citizen Band Radios on Buses) 197

P. L. 97–424: Surface Transportation Assistance Act of 1982 (Title I—Highway Improvement Act of 1982) (Resurfacing Standards; Manpower Study; Monitoring Effects of Double Bottom Trucks; 55 m.p.h. Benefits Study) 199

(*See also* P. L. 98–63 and P. L. 98–78 under *HEALTH RESEARCH*)

TABLES

Chronological List of Laws and Titles of Resultant Reports (Where Called For) 205

Chronological List of Executive Orders 211

INDEX 213

General Information

The National Academy of Sciences is a private, self-perpetuating society of distinguished leaders in scientific and engineering research, dedicated to the furtherance of science and its use for the general welfare. The Academy's charter, an Act of Incorporation passed by the United States Congress and signed by President Abraham Lincoln on March 3, 1863, named the first 50 members of the Academy, empowered it to create its own organization and bylaws, and called upon it to serve as an official adviser, upon request and without fee, to the federal government on any question of science or technology.

The National Academy of Engineering was established in December 1964, under the charter of the National Academy of Sciences, as a parallel organization of distinguished engineers, autonomous in its administration and in the selection of members, and sharing with the National Academy of Sciences its responsibility for advising the federal government.

Most of the activities undertaken by the two Academies are carried out through the Commissions, Offices, and Boards of the National Research Council, which was established by the National Academy of Sciences in 1916, and was perpetuated in 1918 at the request of President Woodrow Wilson. The National Research Council draws upon a wide cross-section of the nation's leading scientists and engineers for advisory services to governmental agencies and the Congress.

The Institute of Medicine was chartered by the National Academy of Sciences in the summer of 1970 to deal with problems associated with the delivery of adequate health services to all sectors of society. It, too, is autonomous in its administration and in the selection of its members.

National Academy of Sciences

Throughout its history, the Academy's broad charter has enabled it to serve as a unique mechanism by which the nation's scientists and engineers can contribute their knowledge and experience to pressing problems and to the advancement of national purpose. The institution's changing program has reflected the nation's changing concerns. The first tasks assigned to the Academy were primarily of domestic relevance, dealing with weights, measures and coinage, magnetic deviation and bottom-fouling in iron ships, wind and current charts and sailing directions, materials for the manufacture of coins, and the prevention of counterfeiting. Today, complex national and international problems such as nuclear war, security, freedom of scientific communication, acid rain precipitation, and the state of education at all levels confront the institution, and some of its major activities stem from the deepening involvement of science and technology in many facets of public policy.

As a scientific organization, the Academy publishes a scholarly journal, *The Proceedings of the National Academy of Sciences*, organizes symposia, and convenes meetings on issues of national importance and urgency. In addition, the Academy supports a number of prizes and scientific awards that recognize the outstanding contributions of individual scientists.

From the original 50 charter members, the National Academy of Sciences has increased its membership to 1,450 as of June 1, 1985; at present, up to 60 new members may be elected at the annual meetings. The membership is divided into 5 classes and 23 sections. By authority of its congressional charter, the membership of the National Academy of Sciences is ultimately responsible for the affairs of the overall organization. In practice, this oversight responsibility is vested in a 17-person Council, consisting of the 5 elected officers of the Academy and 12 additional members.

For the first half century of its history, the Academy conducted its business in borrowed quarters at the Smithsonian Institution. By the end of World War I, the need for its own headquarters had become imperative. A site was acquired near the Lincoln Memorial on the mall in Washington, D.C. and construction funds were raised. A handsome, neoclassic building designed by Bertram Grosvenor Goodhue was completed in time for dedication at the Academy's annual meeting in April 1924. This building was added to the National Register of Historic Places in 1974.

National Academy of Engineering

The National Academy of Engineering was established upon the acceptance of its Articles of Organization by the Council of the National Academy of Sciences in 1964.

The National Academy of Engineering shares with the National Academy of Sciences the responsibility to examine questions of science and technology at the request of the federal government. This role is carried out primarily through engineering-related studies conducted by the National Research Council. The National Academy of Engineering sponsors engineering programs aimed at meeting national needs, seeks to encourage engineering research, and promotes recognition of distinguished engineers.

As of June 1, 1985, the membership of the National Academy of Engineering stood at 1,225.

Institute of Medicine

The Institute of Medicine, established in 1970, conducts studies of policy issues related to health and medicine; issues position statements on these issues; cooperates with the major scientific and professional societies in the field; identifies qualified individuals to serve on study groups in other organizational units; and disseminates information to the public and the relevant professions.

The membership of the Institute stood at 461 on July 1, 1985.

Although the Institute of Medicine is not a part of the formal structure of the National Research Council, its program is subject to approval by the Research Council's Governing Board.

National Research Council

Established in 1916, the National Research Council serves as the operating arm of the National Academy of Sciences and the National Academy of Engineering.

The National Research Council is organized into eight major units—the Commission on Behavioral and Social Sciences and Education; the Commission on Engineering and Technical Systems; the Commission on Life Sciences; the Commission on Physical Sciences, Mathematics, and Resources; the Office of International Affairs; the Office of Scientific and Engineering Personnel; the Board on Agriculture; and the Transportation Research Board.

The work of the Research Council is overseen by a Governing Board whose chairman is the president of the National Academy of Sciences; the president of the National Academy of Engineering serves as vice chairman. In addition, five members each from the Councils of the National Academy of Sciences and the National Academy of Enginering and two members from the Council of the Institute of Medicine serve on the Governing Board. Members of Commissions, Offices, and Boards are appointed by the chairman of the Research Council. Nominations are based upon distinguished contributions to the scientific or engineering field involved, demonstrated ability and interest, and willingness to devote time and effort to the work of the Commission, Office, or Board. Every year, each of the Commissions, Offices, and Boards presents an annual report on its activities to the Governing Board.

New studies and publications are announced monthly in *News Report*, which is available upon request from the Office of Public Affairs. Information on reports and other publications which are for sale may be obtained from the National Academy Press. The address of the Office of Public Affairs and the National Academy Press is National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

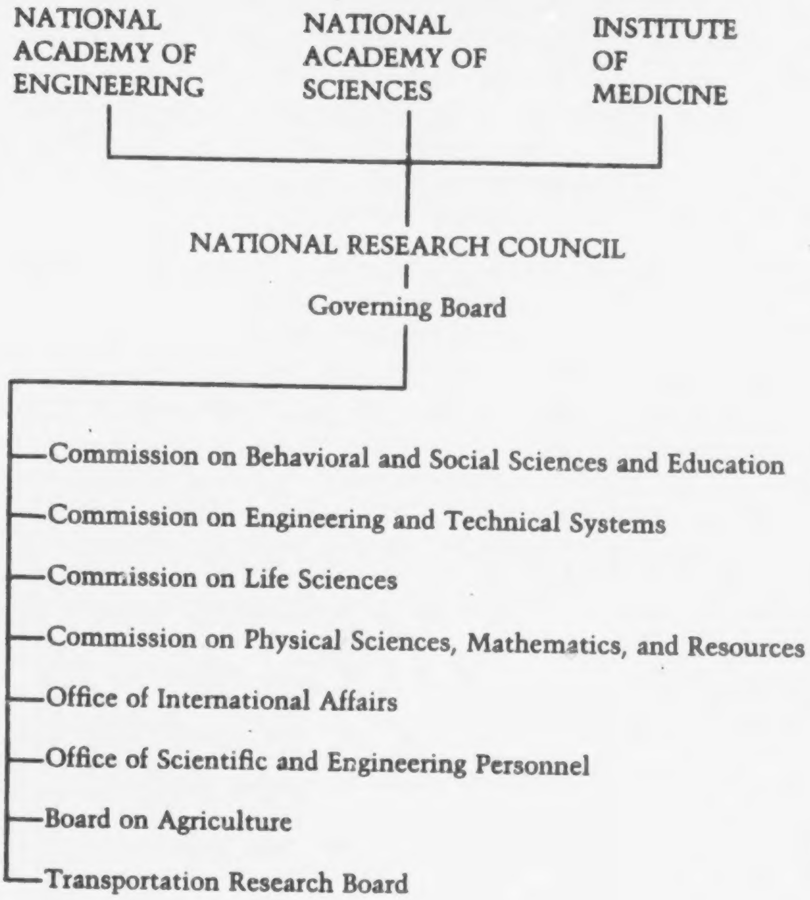
Committee on Science, Engineering, and Public Policy

This committee of the two Academies and the Institute of Medicine is charged with the responsibility "to deliberate on initiatives for new studies in the area of science and technology policy, taking especially into account the concerns and requests of the President's Science Adviser, the director of the National Science Foundation, the chairman of the National Science Board, and the chairmen of key science and technology-related committees of the Congress."

Government–University–Industry Research Roundtable

The Roundtable was created in 1984 to provide a forum where scientists, engineers, administrators, and policymakers from government, universities, and industry can come together on a continuing basis to explore how to improve the productivity of the nation's research enterprise.

Organizational Diagram


NATIONAL ACADEMY OF ENGINEERING
NATIONAL ACADEMY OF SCIENCES
INSTITUTE OF MEDICINE
NATIONAL RESEARCH COUNCIL
Governing Board
Commission on Behavioral and Social Sciences and Education
Commission on Engineering and Technical Systems
Commission on Life Sciences
Commission on Physical Sciences, Mathematics, and Resources
Office of International Affairs
Office of Scientific and Engineering Personnel
Board on Agriculture
Transportation Research Board

Notes

1. All citations of the *United States Code* through the 97th Congress pertain to the 1982 edition, which is current as of January 14, 1983. Citations from the 98th Congress onward are based on information given in the slip law.

2. In those instances where subject matter could be classified in more than one category, the text is printed in one category only and a cross-reference is included both in the table of contents and on the individual section separator page.

3. Some of the governmental department and agency names that have been inserted editorially have changed since the statutes in which they were cited elsewhere were enacted. In such instances, the name of the department or agency at the time of passage of the law has been retained.

4. For information on the availability of reports deriving from the legislation and listed at the end of excerpts, please contact the Office of Government and Public Affairs, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

5. Square brackets indicate editorial insertions.

6. A gap in text is indicated by three asterisks.

Excerpts of Legislation

General

37th Congress, Session 3, Chapter 111:	An Act to Incorporate the National Academy of Sciences (Includes amendments in 41st Congress, Session 2, Chapter 264; 48th Congress, Session 1, Chapter 107; and Public Law 109, 63rd Congress, Session 2, Chapter 101)	3
Executive Order No. 2859	Perpetuation of the National Research Council (Includes amendment in Executive Order No. 10668)	7
P. L. 86–209:	An Act to Establish a National Medal of Science	9
Executive Order No. 11287:	Committee Membership and Recommendations for the National Medal of Science	10
P. L. 90–407:	National Science Foundation Act of 1950, Amendments (National Science Board)	12
P. L. 95–625:	National Parks and Recreation Act of 1978 (Albert Einstein Memorial)	14
P. L. 96–526:	Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1981 (Postperformance Evaluation of Scientific Research)	16

37th Congress - Session 3 - Chapter 111

AN ACT TO INCORPORATE THE NATIONAL ACADEMY OF SCIENCES

12 Stat. 806 March 3, 1863

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as amended by

41st Congress - Session 2 - Chapter 264

AN ACT TO AMEND THE ACT TO INCORPORATE THE NATIONAL ACADEMY OF SCIENCES

16 Stat. 277 July 14, 1870

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and

48th Congress - Session 1 - Chapter 107

AN ACT TO AUTHORIZE THE NATIONAL ACADEMY OF SCIENCES TO RECEIVE AND HOLD TRUST FUNDS FOR THE PROMOTION OF SCIENCE, AND FOR OTHER PURPOSES

23 Stat. 50 June 20, 1884

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and

Public Law 109 - S. 4096
63rd Congress - Session 2 - Chapter 101

AN ACT TO AMEND THE ACT AUTHORIZING THE NATIONAL ACADEMY OF SCIENCES TO RECEIVE AND HOLD TRUST FUNDS FOR THE PROMOTION OF SCIENCE, AND FOR OTHER PURPOSES

38 Stat. 383 May 27, 1914

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Louis Agassiz, Massachusetts; J. H. Alexander, Maryland; S. Alexander, New Jersey; A. D. Bache, at large; F. B. Barnard,[1] at large; J. G. Barnard, United States Army, Massachusetts; W. H. C. Bartlett, United States Military Academy, Missouri; U. A. Boyden,[2] Massachusetts; Alexis Caswell, Rhode Island; William Chauvenet, Missouri; J. H. C. Coffin, United States Naval Academy, Maine; J. A. Dahlgren,[2] United States Navy, Pennsylvania; J. D. Dana, Connecticut; Charles H. Davis, United States Navy, Massachusetts; George Englemann, Saint Louis, Missouri; J. F. Frazer, Pennsylvania; Wolcott Gibbs, New York; J. M. Giless,[3] United States Navy, District of Columbia; A. A. Gould, Massachusetts; B. A. Gould, Massachusetts; Asa Gray, Massachusetts; A. Guyot, New Jersey; James Hall, New York; Joseph Henry, at large; J. E. Hilgard, at large, Illinois; Edward Hitchcock, Massachusetts; J. S. Hubbard, United States Naval Observatory, Connecticut; A. A. Humphreys, United States Army, Pennsylvania; J. L. Le Conte, United States Army, Pennsylvania; J. Leidy, Pennsylvania; J. P. Lesley, Pennsylvania; M. F. Longstreth, Pennsylvania; D. H. Mahan, United States Military Academy, Virginia; J. S. Newberry, Ohio; H. A. Newton, Connecticut; Benjamin Peirce, Massachusetts; John Rodgers, United States Navy, Indiana; Fairman Rogers, Pennsylvania; R. E. Rogers, Pennsylvania; W. B. Rogers, Massachusetts; L. M. Rutherford, New York; Joseph Saxton, at large; Benjamin Silliman, Connecticut; Benjamin Silliman, Junior, Connecticut; Theodore Strong, New Jersey; John Torrey, New York; J. G. Totten, United States Army, Connecticut; Joseph Winlock, United States Nautical Almanac, Kentucky; Jeffries Wyman, Massachusetts; J. D. Whitney, California; their associates and successors duly chosen, are hereby incorporated, constituted, and declared to be a body corporate, by the name of the NATIONAL ACADEMY OF SCIENCES.

SEC. 2 And be it further enacted, That the NATIONAL ACADEMY OF SCIENCES shall consist of not more than fifty ordinary members, and the said corporation hereby constituted shall have power to make its own organization, including its constitution, bylaws, and rules and regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and to report the same to Congress.

SEC. 3. And be it further enacted, That the NATIONAL ACADEMY OF SCIENCES shall hold an annual meeting at such place in the United States as may be designated, and the ACADEMY shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the ACADEMY shall receive no compensation whatever for any services to the Government of the United States.

GALUSHA A. GROW,
Speaker of the House of
Representatives.

SOLOMON FOOT,
President of the Senate
pro tempore.

Approved, March 3, 1863.
ABRAHAM LINCOLN, President.

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[1] The correct name of this charter member was F. A. P. Barnard.
[2] Declined.
[3] The correct name of this charter member was J. M. Gilliss.

[12 Stat. 806-07 36 U.S.C. §§§ 251, 252, 253]

AMENDMENTS:

(1870) Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to incorporate the NATIONAL ACADEMY OF SCIENCES approved March third, eighteen hundred and sixty-three, be, and the same is hereby, so amended as to remove the limitation of the number of ordinary members of said ACADEMY as provided in said act.

[16 Stat. 277 36 U.S.C. § 252]

(1884) Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the NATIONAL ACADEMY OF SCIENCES, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, and its several supplements be, and the same is hereby, authorized and empowered to receive bequests and donations and hold the same in trust, to be applied by the said ACADEMY in aid of scientific investigation and according to the will of the donors.

[23 Stat. 50 36 U.S.C. § 254]

(1914) Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act to authorize the NATIONAL ACADEMY OF SCIENCES to receive and hold trust funds for the promotion of science, and for other purposes, approved June twentieth, eighteen hundred and eighty-four, be, and the same is hereby, amended to read as follows:

"That the NATIONAL ACADEMY OF SCIENCES, incorporated by the act of Congress approved March third, eighteen hundred and sixty-three, be, and the same is hereby, authorized and empowered to receive by devise, bequest, donation, or otherwise, either real or personal property, and to hold the same absolutely or in trust, and to invest, reinvest, and manage the same in accordance with the provisions of its constitution, and to apply said property and the income arising therefrom to the objects of its creation and according to the instructions of the donors: Provided, however, That the Congress may at any time limit the amount of real estate which may be acquired and the length of time the same may be held by said NATIONAL ACADEMY OF SCIENCES."

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

[38 Stat. 383 36 U.S.C. § 254]

Executive Order No. 2859

PERPETUATION OF THE NATIONAL RESEARCH COUNCIL

May 11, 1918

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as amended by

Executive Order No. 10668

AMENDMENT OF EXECUTIVE ORDER NO. 2859 DATED MAY 11, 1918

May 10, 1956

Executive Order No. 2859 of May 11, 1918, relating to the NATIONAL RESEARCH COUNCIL, is hereby amended to read as follows:

NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMY OF SCIENCES

Whereas the NATIONAL RESEARCH COUNCIL (hereinafter referred to as the COUNCIL) was organized in 1916 at the request of the President by the NATIONAL ACADEMY OF SCIENCES, under its congressional charter, as a measure of national preparedness; and

Whereas in recognition of the work accomplished by the NATIONAL ACADEMY OF SCIENCES through the COUNCIL in organizing research, in furthering science, and in securing cooperation of government and non-government agencies in the solution of their problems, the COUNCIL has been perpetuated by the ACADEMY as requested by the President in Executive Order No. 2859 of May 11, 1918; and

Whereas the effective prosecution of the COUNCIL's work requires the close cooperation of the scientific and technical branches of the Government, both military and civil, and makes representation of the Government on the COUNCIL desirable:

Now, therefore, by virtue of the authority vested in me as President of the United States, it is ordered as follows:

1. The functions of the COUNCIL shall be as follows:

(a) In general, to stimulate research in the mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.

(b) To survey the broad possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with such projects.

(c) To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.

(d) To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the Department of Defense and of the civil branches of the Government.

(e) To direct the attention of scientific and technical investigators to the importance of military and industrial problems in connection with national defense, and to aid in the solution of these problems by organizing specific researches.

(f) To gather and collate scientific and technical information, at home and abroad, in cooperation with government and other agencies, and to render such information available to duly accredited persons.

2. The Government shall be represented on the COUNCIL by members who are officers or employees of specified departments and agencies of the executive branch of the Government. The NATIONAL ACADEMY OF SCIENCES shall specify, from time to time, the departments and agencies from which Government members shall be designated, and shall determine, from time to time, the number of Government members who shall be designated from each such department and agency. The head of each such specified department or agency shall designate the officers and employees from his department or agency, in such numbers as the NATIONAL ACADEMY OF SCIENCES shall determine, who shall be members of the COUNCIL, but shall designate only those persons who are acceptable to the ACADEMY.

This order shall not be construed as terminating the tenure of any person who has heretofore been designated as a member of the Council.

DWIGHT D. EISENHOWER

[21 Fed. Reg. 3155, May 12, 1956 36 U.S.C. § 253 note]

Public Law 86-209
86th Congress - H. R. 6288

AN ACT TO ESTABLISH A NATIONAL MEDAL OF SCIENCE

73 Stat. 431 August 25, 1959

There is hereby established a National Medal of Science (hereinafter referred to as the "medal"), which shall be of such design and materials and bear such inscriptions as the President, on the basis of recommendations submitted by the National Science Foundation, may prescribe, and shall be awarded as provided in section 2 of this Act.

SEC. 2. (a) The President shall from time to time award the medal, on the basis of recommendations received from the NATIONAL ACADEMY OF SCIENCES or on the basis of such other information and evidence as he deems appropriate, to individuals who in his judgment are deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, or engineering sciences.

(b) Not more than twenty individuals may be awarded the medal in any one calendar year.

(c) An individual may not be awarded the medal unless at the time such award is made he--

(1) is a citizen or other national of the United States; or

(2) is an alien lawfully admitted to the United States for permanent residence who (A) has filed an application for petition for naturalization in the manner prescribed by section 334(b) of the Immigration and Nationality Act and (B) is not permanently ineligible to become a citizen of the United states.

(d) The presentation of the award shall be made by the President with such ceremonies as he may deem proper, including attendance by appropriate Members of Congress.

[73 Stat. 431 42 U.S.C. §§ 1880, 1881]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 824, August 10, 1959, to accompany H.R. 6288.

Executive Order No. 11287

COMMITTEE MEMBERSHIP AND RECOMMENDATIONS FOR THE NATIONAL MEDAL OF SCIENCE

June 28, 1966

SEC. 2. The President's Committee. (a) There is hereby established the President's Committee on the National Medal of Science (hereinafter referred to as the Committee), which shall be composed of twelve appointive members and two ex officio members and shall assist the President, as provided in this order, in connection with the carrying out of the Act.

(b) Each appointive member of the Committee shall be appointed by the President from among appropriately qualified citizens of the United States. Except as otherwise provided in subsection (e) of this Section, each such member shall be so appointed for a term of three years or for the balance of the unexpired term of his predecessor, whichever is appropriate. Members may be reappointed to serve one additional term of three years. As nearly as practicable, the appointive members of the Committee shall comprise a cross section of the major fields of science and engineering.

(c) The following shall be ex officio members of the Committee:

(1) The Science Adviser.

(2) The President of the NATIONAL ACADEMY OF SCIENCES.

(d) The President shall from time to time designate one of the members of the Committee as Chairman thereof.

(e) Of the persons first designated as members of the Committee under the provisions of subsection (b) of this Section, four shall be designated to serve until December 31, 1966, four shall be designated to serve until December 31, 1967, and four shall be designated to serve until December 31, 1968.

SEC. 3. Preliminary Procedure (a) The Committee shall receive, on behalf of the President, (1) the recommendations made by the NATIONAL ACADEMY OF SCIENCES respecting the award of the Medal pursuant to the provisions of Section 2(a) of the Act [subsec. (a) of this section], and (2) such similar recommendations as may be made by any other nationally representative scientific or engineering organization or other qualified source. Each such recommendation shall include or be accompanied by such appropriate supporting material as the Committee may from time to time specify.

[31 Fed. Reg. 8995, June 30, 1966 42 U.S.C. § 1881 (2), (3a)]

Public Law 90-407
90th Congress - H. R. 5404

NATIONAL SCIENCE FOUNDATION ACT OF 1950, AMENDMENTS

82 Stat. 360
July 18, 1968

SEC. 2. Section 4 of the National Science Foundation Act of 1950 is amended to read as follows:

NATIONAL SCIENCE BOARD

SEC. 4. (a) The Board shall consist of twenty-four members to be appointed by the President, by and with the advice and consent of the Senate, and of the Director ex officio. In addition to any powers and functions otherwise granted to it by this Act, the Board shall establish the policies of the Foundation.

(b) The Board shall have an Executive Committee as provided in section 7, and may delegate to it or to the Director or both such of the powers and functions granted to the Board by this Act as it deems appropriate.

(c) The persons nominated for appointment as members of the Board (1) shall be eminent in the fields of the basic, medical, or social sciences, engineering, agriculture, education, research management, or public affairs; (2) shall be selected solely on the basis of established records of distinguished service; and (3) shall be so selected as to provide representation of the views of scientific leaders in all areas of the Nation. The President is requested, in the making of nominations of persons for appointment as members, to give due consideration to any recommendations for nomination which may be submitted to him by the NATIONAL ACADEMY OF SCIENCES, the National Association of State Universities and Land Grant Colleges, the Association of American Universities, the Association of American Colleges, the Association of State Colleges and Universities, or by other scientific or educational organizations.

[82 Stat. 361 42 U.S.C. § 1863 (a), (b), (c)]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 34 (Committee on Science and Astronautics).
SENATE REPORT:	No. 1137 (Committee on Labor and Public Welfare).
CONGRESSIONAL RECORD:	
Vol. 113 (1967)	Apr. 12, considered and passed House.
Vol. 114 (1968)	May 24, considered and passed Senate, amended. June 27, House concurred in Senate amendments.

Public Law 95-625
95th Congress - S. 791

NATIONAL PARKS AND RECREATION ACT OF 1978

92 Stat. 3467 November 10, 1978

ALBERT EINSTEIN MEMORIAL

SEC. 612. The Secretary of the Interior is authorized to convey for nominal consideration to the NATIONAL ACADEMY OF SCIENCES, United States Reservation 332A, located on the south side of Square Numbered 88 between 21st Street, 22d Street and Constitution Avenue in the District of Columbia to erect and maintain a Memorial to Albert Einstein. The title to said property shall remain with the NATIONAL ACADEMY OF SCIENCES so long as the property is used for access. At such time as the property is no longer used for memorial purposes or public access is restricted, title to said property shall revert to the United States.

[92 Stat. 3521 16 U.S.C. § 431 note]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 95-1165 accompanying H.R. 12536 (Committee on Interior and Insular Affairs).
SENATE REPORT:	No. 95-514 (Committee on Energy and National Resources).
CONGRESSIONAL RECORD: Vol. 123 (1977):	Oct 27, considered and passed Senate.

Vol. 124 (1978):	June 26, July 11, 12, H.R. 12536 considered and passed House. Oct. 4, considered and passed House, amended. Oct. 12, Senate concurred in House amendment with amendments. Oct. 13, House concurred in Senate amendments.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 14, No. 45 (1978):	Nov. 10, Presidential statement.

Public Law 96-526
96th Congress - H. R. 7631

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT--INDEPENDENT AGENCIES APPROPRIATION ACT, 1981

94 Stat. 3044 December 15, 1980

The legislative history discussing the appropriation for the National Science Foundation (NSF) provided for a study of research programs. That history reads in relevant part:

POSTPERFORMANCE EVALUATION [OF SCIENTIFIC RESEARCH]

The Federal investment in science is substantial and, while the benefits of scientific research and education are often obvious, better understanding of the value of particular research results is often needed to make sensible planning and budgetary decisions. The NSF has undertaken some first steps in this process, recently completing its evaluation of the oceanography research program. The postaward evaluation of the NSF chemistry program by the NATIONAL RESEARCH COUNCIL of the NATIONAL ACADEMY OF SCIENCES is continuing.

The Committee remains convinced that postresearch evaluation efforts are meaningful and important. The Committee feels that postperformance evaluation activities will provide the scientific community and the NSF with a better understanding of how successful science is supported and performed. An ongoing examination of selected projects and research programs is necessary in order to provide a clearer insight into what criteria are necessary for the most productive research. There are many subtle variables in this complex equation--the individual researcher, the various strengths of his or her institution, the originality of the idea, the contribution to knowledge the research makes, and others. The Committee feels the need to determine which factors are of primary importance.

As a result, the Committee directs NSF to secure an independent third party to develop a methodology for postperformance evaluation of scientific research endeavors. The NATIONAL ACADEMY OF SCIENCES should be considered, as it has the independence and scientific expertise to assist the Foundation with this task. The Foundation should commit such reasonable resources as are required for this undertaking. This study should strive to identify the criteria and the procedures required for implementing a successful postperformance evaluation effort. The criteria may vary, and it should have some flexibility. The Committee does not feel that this methodological study must rely upon hard statistical data only; there are times when the subjective consensus of the evaluators would suffice. An interim report should be submitted to the Committee by October 1, 1981, and NSF should be prepared to discuss its progress during appropriations hearings next year.

SENATE REPORT NO. 926, 96th Congress, 2nd Session, p. 81 (1980).

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-1114 (Committee on Appropriations). No. 96-1476 (Committee of Conference).
SENATE REPORT:	No. 96-926 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 126 (1980):	July 24, 25, 28, considered and passed House. Sept. 15-19, 22, 23, considered and passed Senate, amended. Dec. 2, House agreed to conference report; receded from its disagreement and concurred in certain Senate amendments and in others with amendments. Dec. 3, Senate agreed to conference report and concurred in House amendments.

REPORT RESULTING FROM THIS LEGISLATION:

The Quality of Research in Science

Agriculture and Food

P. L. 86–618:	Color Additive Amendments of 1960	21
P. L. 95–113:	National Agricultural Research, Extension, and Teaching Policy Act of 1977 (Title XIV of the Food and Agriculture Act of 1977) (Solar Energy Research Information System)	23
P. L. 95–203:	Saccharin Study and Labeling Act	25
P. L. 95–448:	Agriculture, Rural Development, and Related Agencies Appropriations, Fiscal Year 1979 (Antibiotics in Animal Feed and Cotton Dust Standards)	28
P. L. 96–108:	Agriculture, Rural Development and Related Agencies Appropriation, 1980 (Antibiotics in Animal Feed)	32

Public Law 86-618
86th Congress - S. 2197

COLOR ADDITIVE AMENDMENTS OF 1960

74 Stat. 397 July 12, 1960

SEC. 103. (b) Section 706 of [the Federal Food, Drug, and Cosmetic Act] is amended to read as follows:

LISTING AND CERTIFICATION OF COLOR ADDITIVES FOR FOODS, DRUGS, AND COSMETICS

* * *

[ADVISORY COMMITTEE]

SEC. 706. (b)(5)(D) The advisory committee referred to in subparagraph (C)[*] of this paragraph shall be composed of experts selected by the NATIONAL ACADEMY OF SCIENCES, qualified in the subject matter referred to the committee and of adequately diversified professional background, except that in the event of the inability or refusal of the NATIONAL ACADEMY OF SCIENCES to act, the Secretary [of Health, Education, and Welfare] shall select the members of the committee. The size of the committee shall be determined by the Secretary.

[74 Stat. 401 21 U.S.C. § 376(b)(5)(D)]

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[*]SEC. 706(b)(5)(C)(i) In any proceeding for the issuance, amendment, or repeal of a regulation listing a color additive, whether commenced by a proposal of the Secretary on his own initiative or by a proposal contained in a petition, the petitioner, or any other person who will be adversely affected by such proposal or by the Secretary's order issued in accordance with paragraph (1) of section 701(e) if placed in effect, may request, within the time specified in this subparagraph, that the petition or order thereon, or the Secretary's proposal, be referred to an advisory committee for a report and recommendations with respect to any matter arising under subparagraph (B) of this paragraph, which is involved in such proposal or order and which requires the exercise of scientific judgment. Upon

such request, or if the Secretary within such time deems such a referral necessary, the Secretary shall forthwith appoint an advisory committee under subparagraph (D) of this paragraph and shall refer to it, together with all the data before him, such matter arising under subparagraph (B) for study thereof and for a report and recommendations on such matter. A person who has filed a petition or who has requested the referral of a matter to an advisory committee pursuant to this subparagraph (C), as well as representatives of the Department of Health, Education, and Welfare, shall have the right to consult with such advisory committee in connection with the matter referred to it. The request for referral under this subparagraph, or the Secretary's referral on his own initiative, may be made at any time before, or within thirty days after, publication of an order of the Secretary acting upon the petition or proposal.

[74 Stat. 400-01 21 U.S.C. § 376(b)(5)(C)(i)]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 1761, June 7, 1960, to accompany H.R. 7624.
SENATE REPORT:	No. 795, August 21, 1959, to accompany S. 2197.

Public Law 95-113
95th Congress - S. 275

NATIONAL AGRICULTURAL RESEARCH, EXTENSION, AND TEACHING POLICY ACT OF 1977

(TITLE XIV OF THE FOOD AND AGRICULTURE ACT OF 1977)

91 Stat. 981 September 29, 1977

SUBTITLE H--SOLAR ENERGY RESEARCH AND DEVELOPMENT

* * *

PART 3--INFORMATION SYSTEM AND ADVISORY COMMITTEE

SOLAR ENERGY RESEARCH INFORMATION SYSTEM

SEC. 1450. The Secretary [of Agriculture] shall, through the Cooperative State Research Service and other agencies within the Department of Agriculture which the Secretary considers appropriate, in consultation with the Energy Research and Development Administration, other appropriate United States Government agencies, the NATIONAL ACADEMY OF SCIENCES, and private and nonprofit institutions involved in solar energy research projects, by June 1, 1978, and by June 1 in each year thereafter, make a compilation of solar energy research projects related to agriculture which are being carried out during such year by Federal, State, private, and nonprofit institutions and, where available, the results of such projects. Such compilations may include, but are not limited to, projects dealing with heating and cooling methods for farm structures and dwellings (such as greenhouses, curing barns, and livestock shelters), storage of power, operation of farm equipment (including irrigation pumps, crop dryers and curers, and electric vehicles), and the development of new technologies to be used on farms which are powered by other than fossil fuels or derivatives thereof.

[91 Stat. 1012-13 7 U.S.C. § 3251]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-348 accompanying H.R. 7171 (Committee on Agriculture). No. 95-599 (Committee of Conference).
SENATE REPORTS:	No. 95-180 (Committee on Agriculture, Nutrition, and Forestry). No. 95-418 (Committee of Conference).
CONGRESSIONAL RECORD:	
Vol. 123 (1977):	May 23, 24, considered and passed Senate. July 20-22, 25-28, considered and passed House, amended, in lieu of H.R. 7171. Sept. 9, Senate agreed to conference report. Sept. 16, House agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 13, No. 41:	Sept. 29, Presidential statement.

Public Law 95-203
95th Congress - S. 1750

SACCHARIN STUDY AND LABELING ACT

91 Stat. 1451 November 23, 1977

SEC. 2. (a)(1) The Secretary of Health, Education, and Welfare (hereinafter in this Act referred to as the "Secretary") shall arrange, in accordance with subsection (b), for the conduct of a study, based on available information, of--

(A) current technical capabilities to predict the direct or secondary carcinogenicity or other toxicity in humans of substances which are added to, become a part of, or naturally occur in, food and which have been found to cause cancer in animals;

(B) the direct and indirect health benefits and risks to individuals from foods which contain carcinogenic or other toxic substances;

(C) the existing means of evaluating the risks to health from the carcinogenicity or other toxicity of such substances, the existing means of evaluating the health benefits of foods containing such substances, and the existing statutory authority for, and appropriateness of, weighing such risks against such benefits;

(D) instances in which requirements to restrict or prohibit the use of such substances do not accord with the relationship between such risks and benefits; and

(E) the relationship between existing Federal food regulatory policy and existing Federal regulatory policy applicable to carcinogenic and other toxic substances used as other than foods.

(2) The Secretary shall arrange, in accordance with subsection (b), for the conduct of a study to determine, to the extent feasible--

(A) the chemical identity of any impurities contained in commercially used saccharin,

(B) the toxicity or potential toxicity of any such impurities, including their carcinogenicity or potential carcinogenicity in humans, and

(C) the health benefits, if any, to humans resulting from the use of nonnutritive sweeteners in general and saccharin in particular.

(b)(1) The Secretary shall first request the NATIONAL ACADEMY OF SCIENCES (hereinafter in this section referred to as the "ACADEMY"), acting through appropriate units, to conduct the studies, required by subsection (a), under an arrangement whereby the actual expenses incurred by the ACADEMY directly related to the conduct of such studies will be paid by the Secretary. If the ACADEMY agrees to such request, the Secretary shall enter into such an agreement with the ACADEMY.

(2) If the ACADEMY declines the Secretary's request to conduct any such study under such an arrangement, then the Secretary shall enter into a similar arrangement with another appropriate public or nonprofit private entity to conduct such study.

(3) Any arrangement entered into under paragraph (1) or (2) of this subsection for the conduct of a study shall require that such study be completed and reports thereon be submitted within such period as the Secretary may require to meet the requirements of subsection (c).

(c)(1) Within 12 months of the date of the enactment of this Act the Secretary shall report to the Committee on Human Resources of the Senate and the Committee on Interstate and Foreign Commerce of the House of Representatives (A) the results of the study conducted pursuant to subsection (a)(2) (including supporting data and other materials provided by the entity which conducted the study), and (B) any action proposed to be taken on the basis of the results of the study.

(2) Within 15 months of the date of the enactment of this Act the Secretary shall report to the Committee on Human Resources of the Senate and the Committee on Interstate and Foreign Commerce of the House of Representatives (A) the results of the studies (including supporting data and other materials provided by the entity which conducted the study) conducted pursuant to subsection (a)(1), (B) the recommendations, if any, of such entity for legislative and administrative action, and (C) such recommendations for legislative action as the Secretary deems necessary.

(d) For purposes of this section and section 3, the term "saccharin" includes calcium saccharin, sodium saccharin, and ammonium saccharin.

[91 Stat. 1451-52 21 U.S.C. § 343 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-658 accompanying H.R. 8518 (Committee on Interstate and Foreign Commerce). No. 95-810 (Committee of Conference).

SENATE REPORTS:	No. 95-353 (Committee on Human Resources). No. 95-369 (Committee on Commerce, Science, and Transportation).
CONGRESSIONAL RECORD: Vol. 123 (1977):	Sept. 14, 15, considered and passed Senate. Oct. 17, considered and passed House, amended, in lieu of H.R. 8518. Nov. 3, House agreed to conference report. Nov. 4, Senate agreed to conference report.

REPORTS RESULTING FROM THIS LEGISLATION:

Saccharin: Technical Assessment of Risks and Benefits (Part 1), November 1978

Food Safety Policy: Scientific and Societal Considerations (Part 2), March 1979

Public Law 95-448
95th Congress - H. R. 13125

AGRICULTURE, RURAL DEVELOPMENT, AND RELATED AGENCIES APPROPRIATIONS, FISCAL YEAR 1979

92 Stat. 1073 October 11, 1978

[ANTIBIOTICS IN ANIMAL FEED]

The two items in the legislative history which indicate that the NATIONAL ACADEMY OF SCIENCES was to perform two studies read in relevant part as follows:

> At the same time, the Committee [on Appropriations] is concerned at the apparent lack of definitive data associating theoretical scientific concerns about the use of antibiotics in animal feeds with demonstrated human health problems.
>
> There is strong disagreement among reputable scientists as to whether or not the continued subtherapeutic use of these antibiotics would result in any significant human health risk. Antibiotics have been administered at subtherapeutic levels to billions of animals in the U.S. for more than twenty-five years without any indication that human health has ever been adversely affected. There are those who argue that if there were any significant human health problems associated with such use, surely the problems would have developed during more than a quarter century of extensive and continuous use. Further, it is pointed out that there is theoretical risk connected with the use of every health product, whether used for animals or for man. If these antibiotics are banned on solely theoretical grounds, it might seem to establish a precedent so that most, if not all, animal health products could be banned for the same reason. Thus a serious potential problem could develop since, if animal health products can be banned because of theoretical risk, there might be very little incentive for drug manufacturers to do further research to test actual risks and to develop improved animal health products.
>
> The committee recommends that research be done on this matter. In consideration of the scientific disagreement on this question, the possibility of establishing a precedent of banning products on theoretical grounds, and the potential added cost of billions of dollars to consumers, the committee can see no other responsible course of action to properly settle the matter. The bill

includes $250,000 for this additional research, and FDA [the Food and Drug Administration] will be expected to hold in abeyance any and all implementation of their proposal pending the final results not only of the research provided herein, but also of such evidentiary hearings as may result from the notices of opportunity for hearing that have been published by FDA.

The objective of the research should be to compare the health of humans with extensive exposure to animals, and/or their products, receiving antibiotics at the subtherapeutic level with the health of comparable individuals not so exposed.

This research should logically be supervised and conducted by capable, objective scientists who have not already formed strong opinions as to whether or not these antibiotics should continue to be used at subtherapeutic levels for animals. Since FDA has already taken a strong position on the question, the committee urges that FDA contract with the NATIONAL ACADEMY OF SCIENCES to plan and monitor the research.

HOUSE REPORT No. 1290, 95th Congress, 2nd Session, p. 100 (1978).

[COTTON DUST STANDARDS]

Mr. Morgan [Senator from North Carolina]. Mr. President, today I offer an amendment to H.R. 13125, the agriculture, rural development, and related agencies appropriations bill for fiscal year 1979. My amendment would increase the appropriations for the Agricultural Research Service by $200,000 for fiscal year 1979.

The purpose of this increase would be to fund a study, to be conducted by the NATIONAL ACADEMY OF SCIENCES, which would make determinations as to whether the record made in connection with the cotton dust standard promulgated by the Occupational Safety and Health Administration on June 23, 1978 (43 Federal Register 27350) establishes conclusively that the standards are the most appropriate means of assuring safe and healthful workplaces for cotton industry employees and are technologically and economically feasible.

In this amendment, I anticipate that the NATIONAL ACADEMY OF SCIENCES will attempt to establish conclusively, first, that byssinosis can definitely be diagnosed; second, that it is possible to identify the incidence and prevalence of byssinosis or other respiratory diseases that are caused by exposure to cotton dust as opposed to other agents; third, that the incidence of respiratory disease is greater in each sector concerned by the standard as promulgated by

OSHA and the standards are both technologically and economically feasible; fourth, that the standards as promulgated are cost-effective means of assuring safe and healthful workplaces for cotton industry employees; fifth, that the state of the art in pulmonary function testing is sufficiently developed to ascertain whether a 5-percent daily change in pulmonary function, as measured by industrial screening procedures specified by OSHA, is abnormal or evidence of a significant health problem; sixth, that it is possible to accurately measure a 5-percent change in pulmonary function using industrial screening procedures as depicted by the training requirements of the standards; seventh, that the number of medical and health professionals with skills in pulmonary function testing is sufficient to allow industrywide compliance with the standards' medical surveillance provisions; eighth, that a questionnaire typically used by the medical profession (such as the questionnaire required by the standards) is appropriate for industrial screening applications which may be administered by nonmedical personnel; and ninth, that the state of the art in dust measurement is sufficiently developed to permit accurate measurement of worker exposure to lint-free respirable dust.

CONGRESSIONAL RECORD, Vol. 124 (daily edition August 9, 1978), p. S 12973.

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-1290 (Committee on Appropriations). No. 95-1579 (Committee of Conference).
SENATE REPORT:	No. 95-1058 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 124 (1978):	June 22, considered and passed House. Aug. 9, 10, considered and passed Senate, amended. Sept. 26, House agreed to conference report; receded and concurred in Senate amendment No. 83; receded and concurred with amendments in other Senate amendments. Sept. 27, Senate agreed to conference report; concurred in House amendments.

REPORTS RESULTING FROM THIS LEGISLATION:

The Effects on Human Health of Subtherapeutic Use of Antimicrobials in Animal Feeds

Byssinosis: Clinical and Research Issues

Public Law 96-108
96th Congress - H. R. 4387

AGRICULTURE, RURAL DEVELOPMENT AND RELATED AGENCIES APPROPRIATION, 1980

93 Stat. 821 November 9, 1979

The legislative history discussing the appropriation for the Food and Drug Administration provided for a study of antibiotics in animal feed. The legislative history reads in relevant part:

ANTIBIOTICS IN ANIMAL FEED

Last year the Food and Drug Administration [FDA] proposed to restrict severely the subtherapeutic uses of penicillin and tetracyclines for animal health purposes. In response to concerns over the absence of definitive data to confirm the theoretical basis of the agency proposal, FDA has contracted with the NATIONAL ACADEMY OF SCIENCES to review and critique all information available on the subject.

Building upon that foundation, this bill includes, and the agency is to earmark, funds to initiate a program of approximately $1,500,000 for research generating new epidemiological information by comparing the health of humans with extensive exposure to animals (and/or their products) who are receiving antibiotics at the subtherapeutic level, with the health of comparable individuals not so exposed.

The study shall be designed in consultation with qualified epidemiologists available through the NATIONAL ACADEMY OF SCIENCES, and appropriate congressional committees shall be informed of the agreed protocols. Such research and investigation is then to be performed on a contractual basis by a nongovernmental research organization qualified and experienced in the relevant and appropriate scientific disciplines. It is expected that this study will require at least 2 years to complete and may need to be funded incrementally.

FDA will be expected to continue to hold in abeyance any and all implementation of its proposal pending the final results not only of the research provided herein, but also of such evidentiary hearings as may result from the notices of opportunity for hearings that have been published by FDA.

SENATE REPORT No. 246, 96th Congress, 1st Session, p. 100 (1979). See also HOUSE REPORT No. 242, 96th Congress, 1st Session, p. 101 (1979).

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-242 (Committee on Appropriations). No. 96-553 (Committee of Conference).
SENATE REPORT:	No. 96-246 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 125 (1979):	June 19, considered and passed House. July 18, 19, considered and passed Senate, amended. Oct. 26, House agreed to conference report; receded from its disagreement and concurred in certain Senate amendments and in others with amendments. Oct. 31, Senate agreed to conference report and concurred in House amendments.

REPORT RESULTING FROM THIS LEGISLATION:

The Effects on Human Health of Subtherapeutic Use of Antimicrobials in Animal Feeds

Air and Water Pollution

P. L. 91–604:	Clean Air Amendments of 1970 (Motor Vehicle Emission Standards)	37
P. L. 92–500:	Federal Water Pollution Control Act Amendments of 1972 (Effluent Limitations)	41
P. L. 93–523:	Safe Drinking Water Act (National Drinking Water Regulations) (Includes amendments in P. L. 95–190)	44
P. L. 95–95:	Clean Air Act Amendments of 1977 (Air Quality Standards)	49
P. L. 96–294:	Energy Security Act (Carbon Dioxide Study)	55

(See also P. L. 98–466 under TRANSPORTATION—AIR)

Public Law 91-604
91st Congress - H. R. 17255

CLEAN AIR AMENDMENTS OF 1970

84 Stat. 1676 December 31, 1970

MOTOR VEHICLE EMISSION STANDARDS

SEC. 6. (a) Section 202 of the Clean Air Act is amended to read as follows:

ESTABLISHMENT OF STANDARDS

* * *

SEC. 202. (c)(1) The Administrator [of the Environmental Protection Agency] shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct a comprehensive study and investigation of the technological feasibility of meeting the emissions standards required to be prescribed by the Administrator by subsection (b)[*] of this section.

(2) Of the funds authorized to be appropriated to the Administrator by this Act, such amounts as are required shall be available to carry out the study and investigation authorized by paragraph (1) of this subsection.

(3) In entering into any arrangement with the NATIONAL ACADEMY OF SCIENCES for conducting the study and investigation authorized by paragraph (1) of this subsection, the Administrator shall request the NATIONAL ACADEMY OF SCIENCES to submit semiannual reports on the progress of its study and investigation to the Administrator and the Congress, beginning not later than July 1, 1971, and continuing until such study and investigation is completed. The Administrator shall furnish to such ACADEMY at its request any information which the ACADEMY deems necessary for the purpose of conducting the investigation and study authorized by paragraph (1) of this subsection. For the purpose of furnishing such information, the Administrator may use any authority he has under this Act (A) to obtain information from any person, and (B) to require such person to conduct such tests, keep such records, and make such

reports respecting research or other activities conducted by such person as may be reasonably necessary to carry out this subsection.

[84 Stat. 1692 42 U.S.C. § 7521 (c)]

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[*] SUBSEC. (b)(1)(A) The regulations under subsection (a) applicable to emissions of carbon monoxide and hydrocarbons from light duty vehicles and engines manufactured during or after model year 1975 shall contain standards which require a reduction of at least 90 percentum from emissions of carbon monoxide and hydrocarbons allowable under the standards under this section applicable to light duty vehicles and engines manufactured in model year 1970.

(B) The regulations under subsection (a) applicable to emissions of oxides of nitrogen from light duty vehicles and engines manufactured during or after model year 1976 shall contain standards which require a reduction of at least 90 percentum from the average of emissions of oxides of nitrogen actually measured from light duty vehicles manufactured during model year 1971 which are not subject to any Federal or State emission standard for oxides of nitrogen. Such average of emissions shall be determined by the Administrator on the basis of measurements made by him.

(2) Emission standards under paragraph (1), and measurement techniques on which such standards are based (if not promulgated prior to the date of enactment of the Clean Air Amendments of 1970), shall be prescribed by regulation within 180 days after such date.

(3) For purposes of this part--

(A)(i) The term "model year" with reference to any specific calendar year means the manufacturer's annual production period (as determined by the Administrator) which includes January 1 of such calendar year. If the manufacturer has no annual production period, the term "model year" shall mean the calendar year.

(ii) For the purpose of assuring that vehicles and engines manufactured before the beginning of a model year were not manufactured for purposes of circumventing the effective date of a standard required to be prescribed by subsection (b), the Administrator may prescribe regulations defining "model year" otherwise than as provided in clause (i).

(B) The term "light duty vehicles and engines" means new light duty motor vehicles and new light duty motor vehicle engines, as determined under regulations of the Administrator.

(4) On July 1 of 1971, and of each year thereafter, the Administrator shall report to the Congress with respect to the development of systems necessary to implement the emission standards established pursuant to this section. Such reports shall include information regarding the continuing effects of such air pollutants subject to standards under this section on the public health and welfare, the

extent and progress of efforts being made to develop the necessary systems, the costs associated with develop- ment and application of such systems, and following such hearings as he may deem advisable, any recommendations for additional congressional action necessary to achieve the purposes of this Act. In gathering information for the purposes of this paragraph and in connection with any hearing, the provisions of section 307(a) (relating to subpenas) shall apply.

(5)(A) At any time after January 1, 1972, any manufacturer may file with the Administrator an application requesting the suspension for one year only of the effective date of any emission standard required by paragraph (1)(A) with respect to such manufacturer. The Administrator shall make his determination with respect to any such application within 60 days. If he determines, in accordance with the provisions of this subsection, that such suspension should be granted, he shall simultaneously with such determination prescribe by regulation interim emission standards which shall apply (in lieu of the standards required to be prescribed by paragraph (1)(A)) to emissions of carbon monoxide or hydrocarbons (or both) from such vehicles and engines manufactured during model year 1975.

(B) At any time after January 1, 1973, any manufacturer may file with the Administrator an application requesting the suspension for one year only of the effective date of any emission standard required by paragraph (1)(B) with respect to such manufacturer. The Administrator shall make his determination with respect to any such application within 60 days. If he determines, in accordance with the provisions of this subsection, that such suspension should be granted, he shall simultaneously with such determination prescribe by regulation interim emission standards which shall apply (in lieu of the standards required to be prescribed by paragraph (1)(B)) to emissions of oxides of nitrogen from such vehicles and engines manufactured during model year 1976.

(C) Any interim standards prescribed under this paragraph shall reflect the greatest degree of emission control which is achievable by application of technology which the Administrator determines is available, giving appropriate consideration to the cost of applying such technology within the period of time available to manufacturers.

(D) Within 60 days after receipt of the application for any such suspension, and after public hearing, the Administrator shall issue a decision granting or refusing such suspension. The Administrator shall grant such suspension only if he determines that (i) such suspension is essential to the public interest or the public health and welfare of the United States, (ii) all good faith efforts have been made to meet the standards established by this subsection, (iii) the applicant has established that effective control technology, processes, operating methods, or other alternatives are not available or have not been available for a sufficient period of time to achieve compliance prior to the effective date of such standards, and (iv) the study and investigation of the NATIONAL ACADEMY OF SCIENCES conducted pursuant to subsection (c) and other information available to him has not indicated that technology, processes, or other alternatives are available to meet such standards.

(E) Nothing in this paragraph shall extend the effective date of any emission standard required to be prescribed under this subsection for more than one year.

[84 Stat. 1690-92 42 U.S.C. § 7521 (b)]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 91-1146 (Committee on Interstate and Foreign Commerce). No. 91-1783 (Committee of Conference).
SENATE REPORT:	No. 91-1196 (Committee on Public Works).
CONGRESSIONAL RECORD: Vol. 116 (1970):	June 10, considered and passed House. Sept. 21, 22, considered and passed Senate, amended, in lieu of S. 4358. Dec. 18, Senate and House agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Motor Vehicle Emissions

Public Law 92-500
92nd Congress - S. 2770

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972

86 Stat. 816 October 18, 1972

TITLE III--STANDARDS AND ENFORCEMENTS

* * *

NATIONAL STUDY COMMISSION [ON EFFLUENT LIMITATIONS]

SEC. 315. (a) There is established a National Study Commission which shall make a full and complete investigation and study of all of the technological aspects of achieving, and all aspects of the total economic, social, and environmental effects of achieving or not achieving, the effluent limitations and goals set forth for 1983 in section 301(b)(2)[*] of this Act.

* * *

(c) In the conduct of such study, the Commission is authorized to contract with the NATIONAL ACADEMY OF SCIENCES and the NATIONAL ACADEMY OF ENGINEERING (acting through the NATIONAL RESEARCH COUNCIL), the National Institute of Ecology, Brookings Institution, and other nongovernmental entities, for the investigation of matters within their competence.

* * *

(e) A report shall be submitted to the Congress of the results of such investigation and study, together with recommendations, not later than three years after the date of enactment of this title.

[86 Stat. 875-76 33 U.S.C. § 1325 (a), (c), (e)]

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[*]SEC. 301. (b)(2)(A) [N]ot later than July 1, 1983, effluent limitations for categories and classes of point sources, other than publicly owned treatment works, which (i) shall require application of the best available technology economically achievable for such category or class, which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants, as determined in accordance with regulations issued by the Administrator [of the Environmental Protection Agency] pursuant to section 304(b)(2) of this Act, which such effluent limitations shall require the elimination of discharges of all pollutants if the Administrator finds, on the basis of information available to him (including information developed pursuant to section 315, that such elimination is technologically and economically achievable for a category or class of point sources as determined in accordance with regulations issued by the Administrator pursuant to section 304(b)(2) of this Act, or (ii) in the case of the introduction of a pollutant into a publicly owned treatment works which meets the requirements of subparagraph (B) of this paragraph, shall require compliance with any applicable pretreatment requirements and any other requirement under section 307 of this Act; and (B) Not later than July 1, 1983, compliance by all publicly owned treatment works with the requirements set forth in section 201(g)(2)(A) of this Act.

[86 Stat. 845 33 U.S.C. § 1311 (b)(2)]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 92-911 accompanying H.R. 11896 (Committee on Public Works). No. 92-1465 (Committee of Conference).
SENATE REPORTS:	No. 92-414 (Committee on Public Works) No. 92-1236 (Committee of Conference).

CONGRESSIONAL RECORD:	
Vol. 117 (1971):	Nov. 2, considered and passed Senate.
Vol. 118 (1972):	Mar. 27-29, considered and passed House, amended, in lieu of H.R. 11896. Oct. 4, House and Senate agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 8, No. 43 (1972):	Oct. 17, vetoed; Presidential message.
CONGRESSIONAL RECORD:	
Vol. 118 (1972):	Oct. 18, Senate and House overrode veto.

REPORT RESULTING FROM THIS LEGISLATION:

Report to the National Commission on Water Quality

Public Law 93-523
93rd Congress - S. 433

SAFE DRINKING WATER ACT

88 Stat. 1660 December 16, 1974

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as amended by

Public Law 95-190
95th Congress - S. 1528

SAFE DRINKING WATER AMENDMENTS OF 1977

91 Stat. 1393 November 16, 1977

NATIONAL DRINKING WATER REGULATIONS

* * *

SEC. 1412. (e)(1) The Administrator [of the Environmental Protection Agency] shall enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES (or with another independent scientific organization if appropriate arrangements cannot be made with such ACADEMY) to conduct a study to determine (A) the maximum contaminant levels which should be recommended under subsection (b)(2)[*] in order to protect the health of persons from any known or anticipated adverse effects, and (B) the existence of any contaminants the levels of which in drinking water cannot be determined but which may have an adverse effect on the health of persons.

(2) The result of the study shall be reported to Congress no later than 2 years after the date of enactment of this title and revisions thereof reflecting new information which has become available since the most recent previous report shall be reported to the Congress each two years thereafter. The report shall contain (A) a summary and evaluation of relevant publications and unpublished studies; (B) a statement of methodologies and assumptions for estimating the levels at which adverse health effects may occur; (C) a statement of methodologies and assumptions for estimating the margin of safety which should be incorporated in the national

primary drinking water regulations; (D) proposals for recommended maximum contaminant levels for national primary drinking water regulations, based on the methodologies, assumptions, and studies referred to in clauses (A), (B), and (C) and in paragraph (4); (E) a list of contaminants the level of which in drinking water cannot be determined but which may have an adverse effect on the health of persons; and (F) recommended studies and test protocols for future research on the health effects of drinking water contaminants, including a list of the major research priorities and estimated costs necessary to conduct such priority research; and (G) periodic assessments and evaluations of unregulated contaminants which may require continuous monitoring or regulation.

(3) In developing its proposals for recommended maximum contaminant levels under paragraph (2)(D) the NATIONAL ACADEMY OF SCIENCES (or other organization preparing the report) shall evaluate and explain (separately and in composite) the impact of the following considerations:

(A) The existence of groups or individuals in the population which are more susceptible to adverse effects than the normal healthy adult.

(B) The exposure to contaminants in other media than drinking water (including exposures in food, in the ambient air, and in occupational settings) and the resulting body burden of contaminants.

(C) Synergistic effects resulting from exposure to or interaction by two or more contaminants.

(D) The contaminant exposure and body burden levels which alter physiological function or structure in a manner reasonably suspected of increasing the risk of illness.

(4) In making the study under this subsection, the NATIONAL ACADEMY OF SCIENCES (or other organization) shall collect and correlate (A) morbidity and mortality data and (B) monitored data on the quality of drinking water. Any conclusions based on such correlation shall be included in the report of the study.

(5) Neither the report of the study under this subsection nor any draft of such report shall be submitted to the Office of Management and Budget or to any other Federal agency (other than the Environmental Protection Agency) prior to its submission to Congress.

(6) Of the funds authorized to be appropriated to the Administrator by this title, such amounts as may be required shall be available to carry out the study and to make the report directed by paragraph (2) of this subsection.

[88 Stat. 1664-65 42 U.S.C. § 300 g-1 (e)]

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[*]SEC. 1412. (b)(1)(A) Within 10 days of the date the report on the study conducted pursuant to subsection (e) is submitted to Congress, the Administrator shall publish in the Federal Register, and provide opportunity for comment on, the--

(i) proposals in the report for recommended maximum contaminant levels for national primary drinking water regulations, and

(ii) list in the report of contaminants the levels of which in drinking water cannot be determined but which may have an adverse effect on the health of persons.

(B) Within 90 days after the date the Administrator makes the publication required by subparagraph (A), he shall by rule establish recommended maximum contaminant levels for each contaminant which, in his judgment based on the report on the study conducted pursuant to subsection (e), may have any adverse effect on the health of persons. Each such recommended maximum contaminant level shall be set at a level at which, in the Administrator's judgment based on such report, no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety. In addition, he shall, on the basis of the report on the study conducted pursuant to subsection (e), list in the rules under this subparagraph any contaminant the level of which cannot be accurately enough measured in drinking water to establish a recommended maximum contaminant level and which may have any adverse effect on the health of persons. Based on information available to him, the Administrator may by rule change recommended levels established under this subparagraph or change such list.

(2) On the date the Administrator establishes pursuant to paragraph (1)(B) recommended maximum contaminant levels he shall publish in the Federal Register proposed revised national primary drinking water regulations (meeting the requirements of paragraph (3)). Within 180 days after the date of such proposed regulations, he shall promulgate such revised drinking water regulations with such modifications as he deems appropriate.

(3) Revised national primary drinking water regulations promulgated under paragraph (2) of this subsection shall be primary drinking water regulations which specify a maximum contaminant level or require the use of treatment techniques for each contaminant for which a recommended maximum contaminant level is established or which is listed in a rule under paragraph (1)(B). The maximum contaminant level specified in a revised national primary drinking water regulation for a contaminant shall be as close to the recommended maximum contaminant level established under paragraph (1)(B) for such contaminant as is feasible. A required treatment technique for a contaminant for which a recommended maximum contaminant level has been established under paragraph (1)(B) shall

reduce such contaminant to a level which is as close to the recommended maximum contaminant level for such contaminant as is feasible. A required treatment technique for a contaminant which is listed under paragraph (1)(B) shall require treatment necessary in the Administrator's judgment to prevent known or anticipated adverse effects on the health of persons to the extent feasible. For purposes of this paragraph, the term "feasible" means feasible with the use of the best technology, treatment techniques, and other means, which the Administrator finds are generally available (taking cost into consideration).

[88 Stat. 1663-64 42 U.S.C. § 300g-1 (b)]

AMENDMENTS:

(1977) Section 3(c) of Public Law 95-190 amended section 1412(e)(2) by adding provisions relating to revisions of the required report.

[91 Stat. 1394 42 U.S.C. § 300g-1 (e)]

(1977) Section 12(a) of Public Law 95-190 amended section 1412(e)(2) by adding clause (G).

[91 Stat. 1398 42 U.S.C. § 300g-2 (e)]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 93-1185 accompanying H.R. 13002 (Committee on Interstate and Foreign Commerce).
SENATE REPORT:	No. 93-231 (Committee on Commerce).
CONGRESSIONAL RECORD:	
Vol. 119 (1973):	June 22, considered and passed Senate.
Vol. 120 (1974):	Nov. 19, considered and passed House, amended, in lieu of H.R. 13002. Nov. 26, Senate agreed to House amendments with an amendment. Dec. 3, House concurred in Senate amendment.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:
Vol. 10, No. 51 (1974): Dec. 17, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Drinking Water and Health

Public Law 95-95
95th Congress - H. R. 6161

CLEAN AIR ACT AMENDMENTS OF 1977

91 Stat. 685 August 7, 1977

AIR QUALITY STANDARDS

SEC. 106. (a) Section 109 of the Clean Air Act...is amended by adding the following new subsection at the end thereof:

* * *

SEC. 109. (d)(2)(A) The Administrator [of the Environmental Protection Agency] shall appoint an independent scientific review committee composed of seven members including at least one member of the NATIONAL ACADEMY OF SCIENCES, one physician, and one person representing State air pollution control agencies.

(B) Not later than January 1, 1980, and at five-year intervals thereafter, the committee referred to in subparagraph (A) shall complete a review of the criteria published under section 108 and the national primary and secondary ambient air quality standards promulgated under this section and shall recommend to the Administrator any new national ambient air quality standards and revisions of existing criteria and standards as may be appropriate under section 108 and subsection (b) of this section.

(C) Such committee shall also (i) advise the Administrator of areas in which additional knowledge is required to appraise the adequacy and basis of existing, new, or revised national ambient air quality standards, (ii) describe the research efforts necessary to provide the required information, (iii) advise the Administrator on the relative contribution to air pollution concentrations of natural as well as anthropogenic activity, and (iv) advise the Administrator of any adverse public health, welfare, social, economic, or energy effects which may result from various strategies for attainment and maintenance of such national ambient air quality standards.

[91 Stat. 691 42 U.S.C. § 7409 (d)(2)]

OZONE PROTECTION

SEC. 126. Title I of the Clean Air Act is amended by adding at the end thereof the following new part:

* * *

STUDIES BY ENVIRONMENTAL PROTECTION AGENCY

SEC. 153. (d)(1) The Administrator [of the Environmental Protection Agency] shall undertake to contract with the NATIONAL ACADEMY OF SCIENCES to study the state of knowledge and the adequacy of research efforts to understand (A) the effects of all substances, practices, processes, and activities which may affect the stratosphere, especially ozone in the stratosphere; (B) the health and welfare effects of modifications of the stratosphere, especially ozone in the stratosphere; and (C) methods of control of such substances, practices, processes, and activities including alternatives, costs, feasibility, and timing. The ACADEMY shall make a report of its findings by January 1, 1978.

(2) The Administrator shall make available to the ACADEMY such information in the Administrator's possession as is needed for the purposes of the study provided for in this subsection.

[91 Stat. 727 42 U.S.C. § 7453 (d)]

MODELING

SEC. 310. Title III of the Clean Air Act is amended by adding the following new section at the end thereof:

* * *

STANDARDIZED AIR QUALITY MODELING

SEC. 320. (a) Not later than six months after the date of the enactment of the Clean Air Act Amendments of 1977, and at least every three years thereafter, the Administrator [of the Environmental Protection Agency] shall conduct a conference on air quality modeling. In conducting such conference, special attention shall be given to appropriate modeling necessary for carrying out part C of title I (relating to prevention of significant deterioration of air quality).

(b) The conference conducted under this section shall provide for participation by the NATIONAL ACADEMY OF SCIENCES, representatives of State and local air pollution control agencies, and appropriate Federal agencies, including the National Science Foundation; the National Oceanic and Atmospheric Administration, and the National Bureau of Standards.

[91 Stat. 782 42 U.S.C. § 7620 (a), (b)]

NATIONAL COMMISSION ON AIR QUALITY

SEC. 313. Title III of the Clean Air Act is amended by adding the following new section at the end thereof:

* * *

SEC. 323. (f) A report, together with any appropriate recommendations, shall be submitted to the Congress on the results of the investigation and study concerning subsection (a)(3) of this section no later than March 1, 1978, and the results of the investigation and study concerning subsection (b)(2)[*] of this section no later than two years after the date of enactment of the Clean Air Act Amendments of 1977. A report, together with any appropriate recommendations, shall be submitted to the Congress on the results of the investigation and study concerning paragraphs (3) and (8) of subsection (a) of this section no later than March 1, 1978, in order that Congress may have this information in a timely fashion if it deems further changes are needed in the requirements for control of emissions of oxides of nitrogen under this Act, and for other purposes. The Administrator [of the Environmental Protection Agency] shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct a study of the same matters required to be studied by the Commission under subsection (b)(2) and to submit such study to the Congress at the same time as required for the report of the Commission concerning such subsection. Funds shall be available in the same manner, and the Administrator shall have the same authorities and duties respecting such study as provided in the case of the study authorized pursuant to section 202(c) of this title.

* * *

SEC. 323. (j) In the conduct of the study, the Commission is authorized to contract with nongovernmental entities that are competent to perform research or investigations in areas within the Commission's mandate, and to hold public hearings, forums, and workshops to enable full public participation. The Commission may contract with nonprofit technical and scientific organizations, including the NATIONAL ACADEMY OF SCIENCES, for the purpose of developing necessary technical information for the study authorized by subsection (a)(7)[**] of this section.

[91 Stat. 787-88 No longer codified]

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[*]SEC. 323. (b)(2) The Commission shall, in carrying out the study authorized under this section, give priority to a study of the implementation of the provisions of part C (relating to prevention of significant deterioration of air quality) and its effects on the States and the Federal Government. In carrying out such study, the Commission shall study, among other questions, the following:

(A) whether the provisions relating to the designation of, and protection of air quality in class I areas under part C are appropriate to protect the air quality over lands of special national significance, including recommendations for, and methods to, (i) add to or delete lands from such designation, and (ii) provide appropriate protection of the air quality over such lands;

(B) whether the provisions of part C, including the three-hour and twenty-four-hour increments, (i) affect the location and size of major emitting facilities, and (ii) whether such effects are in conflict or consonance with other national policies regarding the development of such facilities;

(C) whether the technology is available to control emissions from the major emitting facilities which are subject to regulation under part C, including an analysis of the costs associated with that technology;

(D) whether the exclusion of nonmajor emitting sources from the regulatory framework under this Act will affect the protection of air quality in class I and class II regions designated under this Act;

(E) whether the increments of change of air quality under this Act are appropriate to prevent significant deterioration of air quality in class I and class II regions designated under part C of title I;

(F) whether the choice of predictive air quality models and the assumptions of those models are appropriate to protect air quality in the class I and class II regions designated under part C of title I for the pollutants subject to regulation under part C; and

(G) the effects of such provisions on employment, energy, the economy (including State and local), the relationship of such policy to the protection of the public health and welfare as well as other national priorities such as economic growth and national defense, and its other social and environmental effects.

[91 Stat. 786-87 No longer codified]

[**]SEC. 323. (a)(7) the extent to which the reduction of hydrocarbon emissions is an adequate or appropriate method to achieve primary standards for photochemical oxidants. Such study shall include--

(A) a description and analysis of the various pollutants which are commonly referred to as "photochemical oxidants" or chemical precursers to photochemical oxidants;

(B) an analysis of any pollutants or combination of pollutants which need to be reduced to achieve any photochemical oxidant standard, and the amount of such reduction;

(C) the relationship between the reductions of hydrocarbons, oxides of nitrogen, and any other pollutants and the achievement of applicable standards for photochemical oxidants;

(D) the degree to which background or natural sources and long-range transportation of pollutants contribute to measured ambient levels of photochemical oxidants;

(E) any other oxidant-related issues which the Commission determines to be appropriate[.]

[91 Stat. 786 No longer codified]

STUDIES

[SUSPENDED PARTICULATE MATTER]

SEC. 403. (a) Not later than eighteen months after the date of the enactment of this Act, the Administrator of the Environmental Protection Agency, in cooperation with the NATIONAL ACADEMY OF SCIENCES, shall study and report to Congress on (1) the relationship between the size, weight, and chemical composition of suspended particulate matter and the nature and degree of the endangerment to public health or welfare presented by such particulate matter (especially with respect to fine particulate matter) and (2) the availability of technology for controlling such particulate matter.

[91 Stat. 792 No longer codified]

* * *

[EMISSION STANDARDS]

(f) The Administrator of the Environmental Protection Agency shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct continuing comprehensive studies and investigations of the effects on public health and welfare of emissions subject to section 202(a) of the Clean Air Act (including sulfur compounds) and the technological feasibility of meeting emission standards required to be prescribed by the Administrator by section 202(b) of such Act. The Administrator shall report to the Congress within six months of the date of enactment of this section and each year thereafter regarding the status of the contractual arrangements and conditions necessary to implement this paragraph.

[91 Stat. 792-93 42 U.S.C. § 7521 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-294 (Committee on Interstate and Foreign Commerce). No. 95-564 (Committee of Conference).
SENATE REPORT:	No. 95-127 accompanying S. 252 (Committee on Environment and Public Works).
CONGRESSIONAL RECORD:	
Vol. 123 (1977):	May 24-26, considered and passed House. June 8, 10, considered and passed Senate, amended. Aug. 4, House and Senate agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 13, No. 33:	Aug. 8, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Protection Against Depletion of Stratospheric Ozone by Chlorofluorocarbons

Public Law 96-294
96th Congress - S. 932

ENERGY SECURITY ACT

94 Stat. 611 June 30, 1980

TITLE VII--ACID PRECIPITATION PROGRAM AND CARBON DIOXIDE STUDY

* * *

SUBTITLE B--CARBON DIOXIDE

STUDY

SEC. 711. (a)(1) The Director of the Office of Science and Technology Policy shall enter into an agreement with the NATIONAL ACADEMY OF SCIENCES to carry out a comprehensive study of the projected impact on the level of carbon dioxide in the atmosphere, of fossil fuel combustion, coal-conversion and related synthetic fuels activities authorized in this Act, and other sources. Such study should also include an assessment of the economic, physical, climatic, and social effects of such impacts. In conducting such study the Office and the ACADEMY are encouraged to work with domestic and foreign governmental and non-governmental entities, and international entities, so as to develop an international, world-wide assessment of the problems involved and to suggest such original research on any aspect of such problems as the ACADEMY deems necessary.

(2) The President shall report to the Congress within six months after the date of the enactment of this Act regarding the status of the Office's negotiations to implement the study required under this section.

(b) A report including the major findings and recommendations resulting from the study required under this section shall be submitted to the Congress by the Office and the ACADEMY not later than three years after the date of the enactment of this Act. The ACADEMY contribution to such report shall not be subject to any prior clearance or review, nor shall any prior clearance or conditions be imposed on the ACADEMY as part of the agreement made by the Office with the ACADEMY under this section. Such report shall in any event include recommendations regarding--

(1) how a long-term program of domestic and international research, monitoring, modeling, and assessment of the causes and effects of varying levels of atmospheric carbon dioxide should be structured, including comments by the Office on the interagency requirements of such a program and comments by the Secretary of State on the international agreements required to carry out such a program;

(2) how the United States can best play a role in the development of such a long-term program on an international basis;

(3) what domestic resources should be made available to such a program;

(4) how the ongoing United States Government carbon dioxide assessment program should be modified so as to be of increased utility in providing information and recommendations of the highest possible value to government policy makers; and

(5) the need for periodic reports to the Congress in conjunction with any long-term program the Office and the ACADEMY may recommend under this section.

(c) The Secretary of Energy, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Director of the National Science Foundation shall furnish to the Office or the ACADEMY upon request any information which the Office or the ACADEMY determines to be necessary for purposes of conducting the study required by this section.

(d) The Office shall provide a separate assessment of the interagency requirements to implement a comprehensive program of the type described in the third sentence of subsection (b).

AUTHORIZATION OF APPROPRIATIONS

SEC. 712. For the expenses of carrying out the carbon dioxide study authorized by section 711 (as determined by the Office of Science and Technology Policy) there are authorized to be appropriated such sums, not exceeding $3,000,000 in the aggregate, as may be necessary. At least 80 percent of any amounts appropriated pursuant to the preceding sentence shall be provided to the NATIONAL ACADEMY OF SCIENCES.

[94 Stat. 774-75 42 U.S.C. §§ 8911, 8912]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-165 accompanying H.R. 3930 (Committee on Banking, Finance, and Urban Affairs). No. 96-1104 (Committee of Conference).
SENATE REPORTS:	No. 96-116 (Committee on Banking, Housing, and Urban Affairs). No. 96-387 (Committee on Energy and Natural Resources and Committee on Banking, Housing, and Urban Affairs). No. 96-824 (Committee of Conference).
CONGRESSIONAL RECORD:	
Vol. 125 (1979):	June 20, considered and passed Senate. June 26, H.R. 3930 considered and passed House, passage vacated and S. 932, amended, passed in lieu. Nov. 5, 7, 8, Senate concurred in House amendments with amendments.
Vol. 126 (1980):	June 19, Senate agreed to conference report. June 26, House agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 16, No. 27 (1980):	June 30, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Changing Climate

Building Science and Technology

P. L. 93–383: Housing and Community Development Act of 1974 (National Institute of Building Sciences) 61

Public Law 93-383
93rd Congress - S. 3066

HOUSING AND COMMUNITY DEVELOPMENT ACT OF 1974

88 Stat. 633 August 22, 1974

TITLE VIII--MISCELLANEOUS

* * *

NATIONAL INSTITUTE OF BUILDING SCIENCES

SEC. 809. (a)(1) The Congress finds (A) that the lack of an authoritative national source to make findings and to advise both the public and private sectors of the economy with respect to the use of building science and technology in achieving nationally acceptable standards and other technical provision for use in Federal, State, and local housing and building regulations is an obstacle to efforts by and imposes severe burdens upon all those who procure, design, construct, use, operate, maintain, and retire physical facilities, and frequently results in the failure to take full advantage of new and useful developments in technology which could improve our living environment; (B) that the establishment of model buildings codes or of a single national building code will not completely resolve the problem because of the difficulty at all levels of government in updating their housing and building regulations to reflect new developments in technology, as well as the irregularities and inconsistencies which arise in applying such requirements to particular localities or special local conditions; (C) that the lack of uniform housing and building regulatory provisions increases the costs of construction and thereby reduces the amount of housing and other community facilities which can be provided; and (D) that the existence of a single authoritative nationally recognized institution to provide for the evaluation of new technology could facilitate introduction of such innovations and their acceptance at the Federal, State, and local levels.

(2) The Congress further finds, however, that while an authoritative source of technical findings is needed, various private organizations, and institutions, private industry, labor, and Federal and other governmental agencies and entities are presently engaged in building research, technology development, testing, and evaluation, standards and model code development and promulgation, and information dissemination. These existing activities should be encour-

aged and these capabilities effectively utilized wherever possible and appropriate to the purposes of this section.

(3) The Congress declares that an authoritative nongovernmental instrument needs to be created to address the problems and issues described in paragraph (1), that the creation of such an instrument should be initiated by the Government, with the advice and assistance of the NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING-NATIONAL RESEARCH COUNCIL (hereinafter referred to as the "ACADEMIES-RESEARCH COUNCIL") and of the various sectors of the building community, including labor and management, technical experts in building science and technology, and the various levels of government.

(b)(1) There is authorized to be established, for the purposes described in subsection (a)(3), an appropriate nonprofit, nongovernmental instrument to be known as the National Institute of Building Sciences (hereinafter referred to as the "Institute"), which shall not be an agency or establishment of the United States Government. The Institute shall be subject to the provisions of this section and, to the extent consistent with this section, to a charter of the Congress if such a charter is requested and issued or to the District of Columbia Nonprofit Corporation Act if that is deemed preferable.

(2) The ACADEMIES-RESEARCH COUNCIL, along with other agencies and organizations which are knowledgeable in the field of building technology, shall advise and assist in (A) the establishment of the Institute; (B) the development of an organizational framework to encourage and provide for the maximum feasible participation of public and private scientific, technical, and financial organizations, institutions, and agencies now engaged in activities pertinent to the development, promulgation, and maintenance of performance criteria, standards, and other technical provisions for building codes and other regulations; and (C) the promulgation of appropriate organizational rules and procedures including those for the selection and operation of a technical staff, such rules and procedures to be based upon the primary object of promoting the public interest and insuring that the widest possible variety of interests and experience essential to the functions of the Institute are represented in the Institute's operations. Recommendations of the ACADEMIES-RESEARCH COUNCIL shall be based upon consultations with and recommendations from various private organizations and institutions, labor, private industry, and governmental agencies entities operating in the field, and the Consultative Council as provided for under subsection (c)(8).

(3) Nothing in this section shall be construed as expressing the intent of the Congress that the ACADEMIES-RESEARCH COUNCIL itself be required to assume any function or operation vested in the Institute by or under this section.

* * *

(8) The Institute shall establish, with the advice and assistance of the ACADEMIES-RESEARCH COUNCIL and other agencies and organizations which are knowledgeable in the field of building technology, a Consultative Council, membership in which shall be available to representatives of all appropriate private trade, professional, and labor organizations, private and public standards, code, and testing bodies, public regulatory agencies, and consumer groups, so as to insure a direct line of communication between such groups and the Institute and a vehicle for representative hearings on matters before the Institute.

[88 Stat. 729-32 12 U.S.C. § 1701j-2]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 93-1114 accompanying H.R. 15361 (Committee on Banking and Currency). No. 93-1279 (Committee of Conference).
SENATE REPORT:	No. 93-693 (Committee on Banking, Housing and Urban Affairs).
CONGRESSIONAL RECORD: Vol. 120 (1974):	Mar. 8, 11, considered and passed Senate. June 20, considered and passed House, amended, in lieu of H.R. 15361. Aug. 13, Senate agreed to conference report. Aug. 15, House agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS: Vol. 10, No. 34:	Aug. 22, Presidential statement.

Environmental Health

P. L. 86–373: Atomic Energy Act of 1954, Amendments (Federal Radiation Council) 67

P. L. 94–317: Disease Control Amendments of 1976 (Title II of the National Consumer Health Information and Health Promotion Act of 1976) (Lead-Based Paint Poisoning) 69

P. L. 95–622: Biomedical Research and Research Training Amendments of 1978 (Title II of the Community Mental Health Centers Act, Amendments) (Low-Level Ionizing Radiation) 71

P. L. 95–623: Health Services Research, Health Statistics, and Health Care Technology Act of 1978 (Study of Costs of Environment-Related Diseases) 74

P. L. 96–205: United States Insular Areas Appropriation Authorization (Radiation Exposure Compensation, Marshall Islands) 77

P. L. 96–528: Agriculture, Rural Development, and Related Agencies Appropriations, Fiscal Year 1980 (Risk Assessment) 80

P. L. 97–35: Consumer Product Safety Amendments of 1981—Subtitle A of Title XII of the Omnibus Budget Reconciliation Act of 1981 (Chronic Hazard Advisory Panel) 82

(See also the section on AIR AND WATER POLLUTION and P. L. 95–448 under AGRICULTURE AND FOOD)

Public Law 86-373
86th Congress - S. 3419

ATOMIC ENERGY ACT OF 1954, AMENDMENTS

73 Stat. 688 September 23, 1959

[FEDERAL RADIATION COUNCIL]

Be it enacted...That the following section be added to the Atomic Energy Act of 1954, as amended:

SEC. 274. Cooperation With States--

* * *

h. There is hereby established a Federal Radiation Council, consisting of the Secretary of Health, Education, and Welfare, the Chairman of the Atomic Energy Commission, the Secretary of Defense, the Secretary of Commerce, the Secretary of Labor, or their designees, and such other members as shall be appointed by the President. The Council shall consult qualified scientists and experts in radiation matters, including the President of the NATIONAL ACADEMY OF SCIENCES, the Chairman of the National Committee on Radiation Protection and Measurement, and qualified experts in the field of biology and medicine, and in the field of health physics. The Special Assistant to the President for Science and Technology, or his designee, is authorized to attend meetings, participate in the deliberations of, and to advise the Council. The Chairman of the Council shall be designated by the President, from time to time, from among the members of the Council. The Council shall advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with States. The Council shall also perform such other functions as the President may assign to it by Executive order.

[73 Stat. 690 42 U.S.C § 2021 note]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 1125, September 2, 1959, to accompany H.R. 8755.
SENATE REPORT:	No. 870, September 1, 1959, to accompany S. 2568.

Public Law 94-317
94th Congress - S. 1466

DISEASE CONTROL AMENDMENTS OF 1976 (TITLE II OF THE NATIONAL CONSUMER HEALTH INFORMATION AND HEALTH PROMOTION ACT OF 1976)

90 Stat. 700 June 23, 1976

EXTENSION AND REVISION OF LEAD-BASED PAINT POISONING PREVENTION ACT

* * *

SEC. 204. (b) Section 401 of such Act...is amended to read as follows:

PROHIBITION AGAINST USE OF LEAD-BASED PAINT IN CONSTRUCTION OF FACILITIES AND THE MANUFACTURE OF CERTAIN TOYS AND UTENSILS

* * *

SEC. 401. (c)(1)(B)(i) The Consumer Product Safety Commission shall, during the six-month period beginning on the date of the enactment of the National Health Promotion and Disease Prevention Act of 1976, determine, on the basis of available data and information and after providing opportunity for an oral hearing and considering recommendations of the Secretary of Health, Education, and Welfare (including those of the Center for Disease Control) and of the NATIONAL ACADEMY OF SCIENCES, whether or not a level of lead in paint which is greater than six one-hundredths of 1 per centum but not in excess of five-tenths of 1 per centum is safe.

[90 Stat. 706 42 U.S.C. § 4841(3)(B)(i)]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 94-1007 accompanying H.R. 12678 (Committee on Interstate and Foreign Commerce).
SENATE REPORT:	No. 94-330 (Committee on Labor and Public Welfare).
CONGRESSIONAL RECORD:	
Vol. 121 (1975):	July 30, considered and passed Senate.
Vol. 122 (1976):	Apr. 7, considered and passed House, amended, in lieu of H.R. 12678. May 26, Senate concurred in amendment, with amendment. June 7, House concurred in Senate amendment.

REPORT RESULTING FROM THIS LEGISLATION:

Recommendations for the Prevention of Lead Poisoning in Children

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Public Law 95-622
95th Congress - S. 2450

BIOMEDICAL RESEARCH AND RESEARCH TRAINING AMENDMENTS OF 1978 (TITLE II OF THE COMMUNITY MENTAL HEALTH CENTERS ACT, AMENDMENTS)

92 Stat. 3420 November 9, 1978

EXPANSION OF RESEARCH AND TESTING AUTHORITY

SEC. 262. [S]ection 301 [of the Public Health Service Act] is amended...by adding at the end the following:

* * *

[LOW-LEVEL IONIZING RADIATION STUDY]

SEC. 301. (b)(2)(A) The Secretary [of Health, Education, and Welfare] shall establish a comprehensive program of research into the biological effects of low-level ionizing radiation under which program the Secretary shall conduct such research and may support such research by others through grants and contracts.

(B) The Secretary shall conduct a comprehensive review of Federal programs of research on the biological effects of ionizing radiation.

[92 Stat. 3435 42 U.S.C. § 241(b)(2)]

The legislative history, which indicates that the NATIONAL ACADEMY OF SCIENCES was to perform the study, provides in relevant part:

It is our intention that the Secretary [of Health, Education, and Welfare] conduct the independent scientific peer review and program management review of federally supported radiation research by contract with the NATIONAL ACADEMY OF SCIENCES. This contractual relationship, of course, assumes that terms of the study, its conduct and its financing, can be agreed upon by NAS and the Secretary. If such contractual relationship cannot be arranged with the NAS, the Secretary shall enter into a similar arrangement with another appropriate public or nonprofit private entity.

The NATIONAL ACADEMY is the preferred agency to conduct the scientific peer review and the management review because of the clear need for totally independent review. The Secretary therefore must assure the contract provides for a full, independent review carried out by carefully selected personnel and conducted in such a way as to assure the integrity and balance of the report. We would expect that the House Commerce Committee and the House Science and Technology Committee will be advised and consulted by the Secretary on a regular basis during the development of the study proposal, negotiations on contract arrangements, and the conduct of the review.

In his arrangements with NAS, the Secretary would be expected to specify the departments and agencies whose research programs are to be included in the scientific and management review. It certainly is expected that the review will include all research on the biological effects of ionizing radiation within the Departments of Energy, Defense, and Health, Education, and Welfare, as well as within the Environmental Protection Agency and the Nuclear Regulatory [Commission].

* * *

Recently, the conduct of this research, especially the program management, has been subject to widespread criticism. In response to those criticisms, and hearings held by my Subcommittee and Mr. Rogers' Subcommittee, I [Mr. George E. Brown, Jr.] and the Gentleman from Florida (Mr. Paul Rogers) contacted a totally independent, highly respected institution--The NATIONAL ACADEMY OF SCIENCES--to provide Congress with a systematic review of this research program and all Federal research programs in this area. In consultation with that group we developed a plan for a comprehensive review of existing research on health effects from ionizing radiation, with particular attention to management of an environmental R&D program, scientific peer review mechanisms and development of a comprehensive future research plan or agenda for further research in this area.

* * *

The present amendment requires the Secretary of the Department of Health, Education, and Welfare to conduct a comprehensive review of Federal research programs on the biological effects of ionizing radiation. The review shall include a brief historical review of such programs, a review of program goals, conduct and management, a review of scientific peer review, review of the responsiveness to public health and safety needs, including the needs of regulatory agencies or departments, and an assessment of the options for future direction of such research. The review of scientific management, peer review and assessment of future research needs, is to be conducted by the NATIONAL ACADEMY OF SCIENCES. The final report is to be submitted to Congress by December 31, 1980.

CONGRESSIONAL RECORD, Vol. 124 (daily edition October 14, 1978), pp. H 13574 and H 13575.

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 95-1192 accompanying H.R. 12347 (Committee on Interstate and Foreign Commerce).
SENATE REPORT:	No. 95-838 (Committee on Human Resources).
CONGRESSIONAL RECORD: Vol. 124 (1978):	June 26, considered and passed Senate. Oct. 15, considered and passed House, amended; Senate concurred in House amendments.

REPORT RESULTING FROM THIS LEGISLATION:

Federal Research on the Biological and Health Effects of Ionizing Radiation

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Public Law 95-623
95th Congress - S. 2466

HEALTH SERVICES RESEARCH, HEALTH STATISTICS, AND HEALTH CARE TECHNOLOGY ACT OF 1978

92 Stat. 3443
November 9, 1978

STUDY OF COSTS OF DISEASES AND ADVERSE EFFECTS ON HUMANS WHICH ARE ENVIRONMENTALLY RELATED

SEC. 7. Section 304 [of the Public Health Service Act] is amended by adding at the end the following:

SEC. 304. (e)(1) The Secretary [of Health, Education, and Welfare] and the NATIONAL ACADEMY OF SCIENCES (acting through the INSTITUTE OF MEDICINE and other appropriate units) shall, jointly and in cooperation with the Administrator of the Environmental Protection Agency, the Secretary of Labor, the Consumer Product Safety Commission, the Council of Economic Advisers, the Council on Wage and Price Stability, the Council on Environmental Quality, and other entities of the Federal Government which the Secretary determines have the expertise in the subject of the study prescribed by this paragraph, conduct, with funds appropriated under section 308 (i)(2), an ongoing study of the present and projected future health costs of pollution and other environmental conditions resulting from human activity (including human activity in any place in the indoor or outdoor environment, including places of employment and residence). In conducting the study, the Secretary and the NATIONAL ACADEMY OF SCIENCES (hereinafter in this subsection referred to as the "ACADEMY") shall, to the extent feasible--

(A) identify the pollution (and the pollutants responsible for the pollution) and other environmental conditions which are, or may reasonably be anticipated to be, responsible for causing, contributing to, increasing susceptibility to, or aggravating human diseases and adverse effects on humans;

(B) identify each such disease and adverse effect on humans and specifically determine whether cancer, birth defects, genetic damage, emphysema, asthma, bronchitis, and other respiratory diseases, heart disease, stroke, and mental illness and impairment are such a disease or effect;

(C) identify (on a national, regional, or other geographical basis) the source or sources of such pollutants and conditions and estimate the portion of each pollutant and the extent of each condition which can be traced to a specific type of source;

(D) ascertain (i) the extent to which the pollutants and conditions identified under subparagraph (A) are, or may reasonably be anticipated to be, responsible, individually or collectively, for causing, contributing to, increasing susceptibility to, or aggravating the diseases and effects identified under subparagraph (B) and (ii) the effect upon the incidence or severity of specific diseases and effects of individual or collective, as appropriate, incremental reductions in the pollutants and changes in such conditions; and

(E) quantify (i) the present and projected future health costs of the diseases and effects identified under subparagraph (B), and (ii) the reduction in health costs which would result from each incremental reduction and change referred to in subparagraph (D)(ii).

(2) The Secretary shall enter into appropriate arrangements with the ACADEMY under which the Secretary shall be responsible for expenses incurred by the ACADEMY in connection with the study prescribed by paragraph (1).

(3) The first report on the study prescribed by paragraph (1) shall be made to the Committee on Human Resources of the Senate and the Committee on Interstate and Foreign Commerce of the House of Representatives by the Secretary and the ACADEMY not later than eighteen months after the date of the enactment of this subsection. Subsequent reports on the study shall be made by the Secretary and the ACADEMY every two years after the date the first report is submitted. Each report shall (A) identify deficiencies and limitations in the data on the matters considered in the study and recommend actions which may be taken to eliminate such deficiencies and limitations, (B) include such recommendations for legislation as the Secretary determines appropriate, (C) include recommendations for facilitating studies of the effects of hazardous substances on humans, and (D) include a description of any administrative action proposed to be taken by the Secretary, the Administrator of the Environmental Protection Agency, the Secretary of Labor, and the Consumer Product Safety Commission to reduce the costs which have been quantified under paragraph (1)(E)(i). In conducting the study, the Secretary and the ACADEMY shall seek assistance from public and private health financing entities in securing the data needed for the study.

(4) For purposes of paragraph (1), the term "health costs of pollution and other environmental conditions" means the costs of human diseases and other adverse effects on humans which pollution and other environmental conditions are, or may reasonably be anticipated to be, responsible for causing, contributing to, increasing susceptibility to, or aggravating, including the costs of preventing such diseases and effects, the costs of the treatment, cure, con-

valescence, and rehabilitation of persons afflicted by such diseases, costs reasonably attributable to pain and suffering from such diseases and effects, loss of income and future earnings resulting from such diseases and effects, adverse effects on productivity (and thus increases in production costs and consumer prices) resulting from such diseases and effects, loss of tax revenues resulting from such decreases in earnings and productivity, costs to the welfare and unemployment compensation systems and the programs of health benefits under titles XVIII and XIX of the Social Security Act resulting from such diseases and effects, the overall increases in costs throughout the economy resulting from such diseases and effects, and other related direct and indirect costs.

[92 Stat. 3451-53 42 U.S.C. § 242b (d)]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-1190 accompanying H.R. 12584 (Committee on Interstate and Foreign Commerce). No. 95-1783 (Committee of Conference).
SENATE REPORT:	No. 95-839 (Committee on Human Resources).
CONGRESSIONAL RECORD:	
Vol. 124 (1978):	June 26, considered and failed of passage in Senate. Aug. 9, considered and passed Senate. Sept. 25, H.R. 12584 considered and passed House; passage vacated, and S. 2466, amended, passed in lieu. Oct. 13, House agreed to conference report. Oct. 15, Senate agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Costs of Environment-Related Health Effects: A Plan for Continuing Study

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Public Law 96-205
96th Congress - H. R. 3756

UNITED STATES INSULAR AREAS APPROPRIATION AUTHORIZATION

94 Stat. 84 March 12, 1980

TITLE I--TRUST TERRITORY OF THE PACIFIC ISLANDS

* * *

SEC. 102. The Act entitled "An Act to authorize certain appropriations for the territories of the United States, to amend certain Acts relating thereto, and for other purposes" (91 Stat. 1159; Public Law 95-134) is amended by inserting after section 105, the following new section:

[RADIATION EXPOSURE COMPENSATION, SCIENTIFIC ADVISORY COMMITTEE]

SEC. 106. (a) In addition to any other payments or benefits provided by law to compensate inhabitants of the atolls of Bikini, Enewetak, Rongelap, and Utirik, in the Marshall Islands, for radiation exposure or other losses sustained by them as a result of the United States nuclear weapons testing program at or near their atolls during the period 1946 to 1958, the Secretary of the Interior (hereinafter in this section referred to as the "Secretary") shall provide for the people of the atolls of Bikini, Enewetak, Rongelap, and Utirik and for the people of such other atolls as may be found to be or to have been exposed to radiation from the nuclear weapons testing program, a program of medical care and treatment and environmental research and monitoring for any injury, illness, or condition which may be the result directly or indirectly of such nuclear weapons testing program. The program shall be implemented according to a plan developed by the Secretary in consultation with the Secretaries of Defense, Energy, and Health, Education, and Welfare and with the direct involvement of representatives from the people of each of the affected atolls and from the government of the Marshall Islands. The plan shall set forth, as appropriate to the situation, condition, and needs of the individual atoll peoples:

(1) an integrated, comprehensive health care program including primary, secondary, and tertiary care with special emphasis upon the biological effects of ionizing radiation;

(2) a schedule for the periodic comprehensive survey and analysis of the radiological status of the atolls to and at appropriate intervals, but not less frequently than once every five years, the development of an updated radiation dose assessment, together with an estimate of the risks associated with the predicted human exposure, for each such atoll; and

(3) an education and information program to enable the people of such atolls to more fully understand nuclear radiation and its effects.

(b)(1) The Secretary shall submit the plan to the Congress no later than January 1, 1981, together with his recommendations, if any, for further legislation. The plan shall set forth the specific agencies responsible for implementing the various elements of the plan. With respect to general health care the Secretary shall consider, and shall include in his recommendations, the feasibility of using the Public Health Service. After consultation with the Chairman of the NATIONAL ACADEMY OF SCIENCES, the Secretary of Energy, the Secretary of Defense, and the Secretary of Health, Education, and Welfare, the Secretary shall establish a scientific advisory committee to review and evaluate the implementation of the plan and to make such recommendations for its improvement as such committee deems advisable.

(2) At the request of the Secretary, any Federal agency shall provide such information, personnel, facilities, logistical support, or other assistance as the Secretary deems necessary to carry out the functions of this program; the costs of all such assistance shall be reimbursed to the provider thereof out of the sums appropriated pursuant to this section.

(3) All costs associated with the development and implementation of the plan shall be assumed by the Secretary of Energy and effective October 1, 1980, there are authorized to be appropriated to the Secretary of Energy such sums as may be necessary to achieve the purposes of this section.

(c) The Secretary shall report to the appropriate committees of the Congress, and to the people of the affected atolls annually, or more frequently if necessary, on the implementation of the plan. Each such report shall include a description of the health status of the individuals examined and treated under the plan, an evaluation by the scientific advisory committee, and any recommendations for improvement of the plan. The first such report shall be submitted not later than January 1, 1982.

[94 Stat. 84-85 48 U.S.C. § 1681 notes]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 96-120 (Committee on Interior and Insular Affairs).
SENATE REPORT:	No. 96-467 (Committee on Energy and Natural Resources).
CONGRESSIONAL RECORD:	
Vol. 125 (1979):	May 7, considered and passed House.
Vol. 126 (1980):	Feb. 7, considered and passed Senate, amended.
	Feb. 25, House concurred in Senate amendment with amendments.
	Feb. 28, Senate concurred in House amendments.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 16, No. 11 (1980):	Mar. 12, Presidential statement.

Public Law 96-528
96th Congress - H. R. 7591

AGRICULTURE, RURAL DEVELOPMENT, AND RELATED AGENCIES APPROPRIATIONS, FISCAL YEAR 1980

94 Stat. 3095 December 15, 1980

The appropriation for the Food and Drug Administration included an amount for a contract with the NATIONAL ACADEMY OF SCIENCES. The legislative history of the Act provides in relevant part:

> ### STUDY OF RISK ASSESSMENT
>
> The increase to the House bill includes $500,000 so that arrangements can be made for a study by the NATIONAL ACADEMY OF SCIENCES or similar organization, of alternative programs and institutional means to insure that Federal regulatory policies with respect to carcinogens and other public health hazards of particular national significance are developed on the basis of reliable scientific assessments. Major purposes of the study are: (1) to assess the merits of an institutional separation of the scientific functions of developing objective risk assessment from the regulatory process of making public and social policy decisions, (2) to consider the feasibility of unifying risk assessment functions, (3) to consider the feasibility of developing coherent risk assessment guidelines for use by all regulatory agencies with decision making responsibility, and (4) to address relevant procedural and institutional issues that may arise in the interaction between the suggested programs of risk assessment and the regulatory process.
>
> The Committee will expect that a report be submitted simultaneously to both the Congress and the Department [of Health and Human Services] no later than June 1982.

SENATE REPORT No. 1030, 96th Congress, 2nd Session, p. 99 (1980).

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-1095 (Committee on Appropriations). No. 96-1519 (Committee of Conference).
SENATE REPORT:	No. 96-1030 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 126 (1980):	July 29, 30, considered and passed House. Nov. 25, considered and passed Senate, amended. Dec. 4, House agreed to conference report; receded from its disagreement and concurred in certain Senate amendments and in others with amendments, Senate agreed to conference report and concurred in House amendments.

REPORT RESULTING FROM THIS LEGISLATION:

Risk Assessment in the Federal Government: Managing the Process

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Public Law 97-35
97th Congress - H. R. 3982

CONSUMER PRODUCT SAFETY AMENDMENTS OF 1981 (SUBTITLE A OF TITLE XII OF THE OMNIBUS BUDGET RECONCILIATION ACT OF 1981)

95 Stat. 357 August 13, 1981

CHRONIC HAZARDS

SEC. 1206. (a) The following section is inserted after section 27 [of the Consumer Product Safety Act]:

CHRONIC HAZARD ADVISORY PANEL

SEC. 28. (a) The Commission shall appoint Chronic Hazard Advisory Panels (hereinafter referred to as the Panel or Panels) to advise the Commission in accordance with the provisions of section (31)(b) respecting the chronic hazards of cancer, birth defects, and gene mutations associated with consumer products.

(b) Each Panel shall consist of 7 members appointed by the Commission from a list of nominees who shall be nominated by the President of the NATIONAL ACADEMY OF SCIENCES from scientists--

(1) who are not officers or employees of the United States, and who do not receive compensation from or have any substantial financial interest in any manufacturer, distributor, or retailer of a consumer product; and

(2) who have demonstrated the ability to critically assess chronic hazards and risks to human health presented by the exposure of humans to toxic substances or as demonstrated by the exposure of animals to such substances.

The President of the NATIONAL ACADEMY OF SCIENCES shall nominate for each Panel a number of individuals equal to three times the number of members to be appointed to the Panel.

[95 Stat. 716 15 U.S.C. § 2077]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 97-158, vols. I-III (Committee on the Budget). No. 97-208, bks. 1, 2 (Committee of Conference).
SENATE REPORT:	No. 97-139, accompanying S. 1377 (Committee on the Budget).
CONGRESSIONAL RECORD: Vol. 127 (1981):	June 22-25, S. 1377 considered and passed Senate. June 25, 26, considered and passed House. July 13, considered and passed Senate, amended, in lieu of S. 1377. July 31, House and Senate agreed to conference report.

Environmental Protection

P. L. 91–441:	Armed Forces Appropriation Authorization, 1971 (Herbicides and Defoliation Study)	87
P. L. 92–516:	Federal Environmental Pesticide Control Act of 1972 (Public Hearings and Scientific Review)	89
P. L. 93–135:	Agriculture-Environmental and Consumer Protection Appropriation Act (Study of Environmental Protection Agency Programs)	93
P. L. 95–477:	Environmental Research, Development, and Demonstration Authorization Act of 1979	97
P. L. 96–229:	Environmental Research, Development, and Demonstration Authorization Act of 1980 (Non-Nuclear Hazardous Waste Disposal Study)	99

(See also P. L. 95–87 under LAND AND RESOURCE MANAGEMENT)

Public Law 91-441
91st Congress - H. R. 17123

ARMED FORCES APPROPRIATION AUTHORIZATION, 1971

84 Stat. 905 October 7, 1970

[HERBICIDES AND DEFOLIATION STUDY]

SEC. 506. (c)(1) The Secretary of Defense shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct a comprehensive study and investigation to determine (A) the ecological and physiological dangers inherent in the use of herbicides, and (B) the ecological and physiological effects of the defoliation program carried out by the Department of Defense in South Vietnam.

(2) Of the funds authorized by this Act for research, development, testing, and evaluation of chemical warfare agents and for defense against biological warfare agents, such amounts as are required shall be available to carry out the study and investigation authorized by paragraph (1) of this subsection.

(3) In entering into any arrangement with the NATIONAL ACADEMY OF SCIENCES for conducting the study and investigation authorized by paragraph (1) of this subsection, the Secretary of Defense shall request that the NATIONAL ACADEMY OF SCIENCES submit a final report containing the results of its study and investigation to the Secretary not later than January 31, 1972. The Secretary shall transmit copies of such report to the President and the Congress, together with such comments and recommendations as he deems appropriate, not later than March 1, 1972.

[84 Stat. 913 10 U.S.C § 2358 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 91-1022 (Committee on Armed Services). No. 91-1473 (Committee of Conference).

SENATE REPORT: No. 91-1016 (Committee on Armed Services).

CONGRESSIONAL RECORD:
Vol. 116 (1970):
Apr. 29, 30, May 6, considered and passed House.
May 5, 7, July 23, 24, 27-31, Aug. 3-7, 10-14, 17-21, 24-28, 31, considered in Senate.
Sept. 1, considered and passed Senate, amended.
Sept. 29, House agreed to conference report.
Oct. 1, Senate agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

The Effects of Herbicides in South Vietnam

Public Law 92-516
92nd Congress - H. R. 10729

FEDERAL ENVIRONMENTAL PESTICIDE CONTROL ACT OF 1972

86 Stat. 973 October 21, 1972

PUBLIC HEARINGS AND SCIENTIFIC REVIEW

SEC. 6. (d) In the event a hearing is requested pursuant to subsection (b)[*] or determined upon by the Administrator [of the Environmental Protection Agency] pursuant to subsection (b), such hearing shall be held after due notice for the purpose of receiving evidence relevant and material to the issues raised by the objections filed by the applicant or other interested parties, or to the issues stated by the Administrator, if the hearing is called by the Administrator rather than by the filing of objections. Upon a showing of relevance and reasonable scope of evidence sought by any party to a public hearing, the Hearing Examiner shall issue a subpena to compel testimony or production of documents from any person. The Hearing Examiner shall be guided by the principles of the Federal Rules of Civil Procedure in making any order for the protection of the witness or the content of documents produced and shall order the payment of reasonable fees and expenses as a condition to requiring testimony of the witness. On contest, the subpena may be enforced by an appropriate United States district court in accordance with the principles stated herein. Upon the request of any party to a public hearing and when in the Hearing Examiner's judgment it is necessary or desirable, the Hearing Examiner shall at any time before the hearing record is closed refer to a Committee of the NATIONAL ACADEMY OF SCIENCES the relevant questions of scientific fact involved in the public hearing. No member of any committee of the NATIONAL ACADEMY OF SCIENCES established to carry out the functions of this section shall have a financial or other conflict of interest with respect to any matter considered by such committee. The Committee of the NATIONAL ACADEMY OF SCIENCES shall report in writing to the Hearing Examiner within 60 days after such referral on these questions of scientific fact. The report shall be made public and shall be considered as part of the hearing record. The Administrator shall enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to assure an objective and competent scientific review of the questions presented to Committees of the ACADEMY and to provide such other scientific advisory services as may be required by the Administrator for carrying out the purpose of this Act. As soon as practicable after completion of the hearing (including the report of the ACADEMY) but not later than 90 days thereafter, the Administrator shall evaluate the data and reports before him and issue an order either revoking his notice of intention issued pursuant to this section, or shall issue an order either canceling the registration, changing the classification, denying the registration, or requiring modification of the labeling or packaging of the article. Such order shall be based only on substantial evidence of record of such hearing and shall set forth detailed findings of fact upon which the order is based.

[86 Stat. 986 7 U.S.C. § 136d (d)]

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[*]SEC. 6. (b) [CANCELLATION AND CHANGE IN CLASSIFICATION.] If it appears to the Administrator that a pesticide or its labeling or other material required to be submitted does not comply with the provisions of this Act or, when used in accordance with widespread and commonly recognized practice, generally causes unreasonable adverse effects on the environment, the Administrator may issue a notice of his intent either—.

(1) to cancel its registration or to change its classification together with the reasons (including the factual basis) for his action, or

(2) to hold a hearing to determine whether or not its registration should be canceled or its classification changed.

Such notice shall be sent to the registrant and made public. The proposed action shall become final and effective at the end of 30 days from receipt by the registrant, or publication, of a notice issued under paragraph (1), whichever occurs later, unless within that time either (i) the registrant makes the necessary corrections, if possible, or (ii) a request for a hearing is made by a person adversely affected by the notice. In the event a hearing is held pursuant to such a request or to the Administrator's determination under paragraph (2), a decision pertaining to registration or classification issued after completion of such hearing shall be final.

[86 Stat. 984 7 U.S.C. § 136d (b)]

The role of the NATIONAL ACADEMY OF SCIENCES is set out in the legislative history, which provides in relevant part:

> Subsection (d) sets forth procedures for hearings pursuant to Subsection (b) and provides for scientific review. When an applicant requests a public hearing, at the outset of such hearing any party (including the hearing officer) may refer questions of scientific fact to a Committee of the NATIONAL ACADEMY OF SCIENCES. Such Committee would be required to report in writing to the hearing officer within sixty days on these questions of scientific fact and the report would be made public and considered as part of the hearing record.
>
> This language in the bill relating to scientific advice would maintain a role for scientific advisory committees of the NATIONAL ACADEMY OF SCIENCES equivalent to that in the present provisions of FIFRA [Federal Insecticide, Fungicide, and Rodenticide Act]. The amended language would have the further benefit of allowing the advisory committee to consider questions of scientific fact while the public hearing is in process rather than in a completely separate administrative review process which causes long delays and division of responsibility for actions under the Act. However, the Committee would meet outside of the public hearing so that the scientists who participate would not be subject to cross-examination and other procedural strictures.

SENATE REPORT No. 838, 92nd Congress, 2nd Session, pp. 23-24, reprinted in 1972 U. S. CODE CONGRESSIONAL AND ADMINISTRATIVE NEWS, pp. 4015-16.

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 92-511 (Committee on Agriculture). No. 92-1540 (Committee of Conference).
SENATE REPORTS:	No. 92-838 (Committee on Agriculture and Forestry). No. 92-970 (Committee on Commerce).

CONGRESSIONAL RECORD:	
Vol. 117 (1971):	Nov. 8, 9, considered and passed House.
Vol. 118 (1972):	Sept. 26, considered and passed Senate, amended.
	Oct. 5, Senate agreed to conference report.
	Oct. 12, House agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 8, No. 44 (1972):	Oct. 21, Presidential statement.

Public Law 93-135
93rd Congress - H. R. 8619

AGRICULTURE-ENVIRONMENTAL AND CONSUMER PROTECTION APPROPRIATION ACT

87 Stat. 468 October 24, 1973

TITLE III--ENVIRONMENTAL PROGRAMS

* * *

ENVIRONMENTAL PROTECTION AGENCY

* * *

ABATEMENT AND CONTROL

* * *

For an amount for a study by the NATIONAL ACADEMY OF SCIENCES, $5,000,000 in connection with the Environmental Protection Agency.

[87 Stat. 482 Not codified]

The purpose of this study is set out in the legislative history, which reads in relevant part:

STUDY OF ENVIRONMENTAL PROGRAMS

Because of all the problems [EPA priorities, regulations, deadlines, etc.] discussed above, the Committee [on Appropriations] recommends an appropriation of $5,000,000 for a complete and thorough review of the programs of the Environmental Protection Agency. The studies shall be conducted under contract with the NATIONAL ACADEMY OF SCIENCES which has a reputation for technical competence and complete objectivity, and shall include, but not be limited to:

(1) The estimated cost of pollution abatement activities over the next decade and the benefits to be derived versus the cost. (If we are to spend $287 billion over the next decade, as estimated by EPA, how can we get the maximum pollution control for our money?);

(2) The degree to which environmental regulations have contributed or will contribute to the current and the long-term energy crisis;

(3) The effect of emission control standards on the cost and performance of automobiles, including the cost/benefit implications of present standards;

(4) The benefits and hazards to humans of agricultural and home use chemicals, such as pesticides, herbicides, rodenticides and fertilizers; and the effect on food and fiber production and the protection of human health of the inability to use those chemicals now banned or restricted; and

(5) The utilization of scientific and technical personnel and the identification of policy level positions that should be staffed with scientific or technical personnel.

The Committee feels that this study will provide the information needed to better assess where we are headed and whether or not the cost of getting there is equal to the benefits. EPA will be expected to submit periodic reports to the Committee on the progress of these studies. Copies of the final report shall be provided to the appropriate executive departments and agencies and to the Congress.

HOUSE REPORT No. 275, 93rd Congress, 1st Session, p. 59 (1973).

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 93-275 (Committee on Appropriations). No. 93-520 (Committee of Conference).
SENATE REPORT:	No. 93-253 (Committee on Appropriations).

CONGRESSIONAL RECORD:
Vol. 119 (1973):

June 25, considered and passed House.
June 28, considered and passed Senate, amended.
Sept. 25, House agreed to conference report; concurred in Senate amendments with amendments.
Oct. 10, Senate agreed to conference report and agreed to House amendments.

REPORTS RESULTING FROM THIS LEGISLATION:

Vol. No.	Title of Report
I	Perspectives on Technical Information for Environmental Protection
II	Decision Making in the Environmental Protection Agency
III	Research and Development in the Environmental Protection Agency IIIa: Sources of Residuals and Techniques for Their Control: Research and Development Needs IIIb: Fates of Pollutants: Research and Development Needs IIIc: Effects of a Polluted Environment: Research and Development Needs IIId: Environmental Impacts of Resource Management: Research and Development Needs
IV	Environmental Monitoring
V	Manpower for Environmental Pollution Control
VI	Implications of Environmental Regulations for Energy Production and Consumption
VII	Pesticide Decision Making
VIII	Noise Abatement: Policy Alternatives for Transportation

IX	Multimedium Management of Municipal Sludge
X	Disposal in the Marine Environment: An Oceanographic Assessment

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Public Law 95-477
95th Congress - H. R. 11302

ENVIRONMENTAL RESEARCH, DEVELOPMENT, AND DEMONSTRATION AUTHORIZATION ACT OF 1979

92 Stat. 1507 October 18, 1978

[COORDINATION OF ENVIRONMENTAL RESEARCH, DEVELOPMENT, AND DEMONSTRATION EFFORTS; STUDY]

SEC. 3. (c)(1) There is authorized to be appropriated to the Environmental Protection Agency for the fiscal year 1979, $1,000,000, and for the fiscal year 1980, $1,000,000, for a study and report, to be conducted outside the Federal Government, on (A) coordination of the Federal Government's efforts in environmental research, development, and demonstration, and (B) the application of the results of such efforts to environmental problems.

(2) The study shall be conducted under a contract let by the Administrator. Such contract shall (A) be developed in consultation with an interagency advisory committee whose membership includes representatives of the Office of Management and Budget and of all agencies conducting or using the results of environmental research, and (B) provide for an oversight and review role by the NATIONAL ACADEMY OF SCIENCES.

(3) The study shall conclude with a report to be submitted to the President, the Administrator, and the Congress within two years after the date of the enactment of this Act. The report shall include recommendations for action by the President, the Administrator, other agencies, or the Congress, as may be appropriate.

(4) The report shall not be subject to any prior clearance or review (except as specifically provided in this subsection), nor shall any such prior clearance be a part of the contract let under paragraph (2).

[92 Stat. 1509 42 U.S.C. § 4366 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-985 (Committee on Science and Technology). No. 95-1593 (Committee of Conference).
SENATE REPORT:	No. 95-877 (Committee on Environment and Public Works).
CONGRESSIONAL RECORD: Vol. 124 (1978):	Apr. 27, considered and passed House. May 26, considered and passed Senate, amended. Sept. 26, Senate agreed to conference report. Oct. 4, House agreed to conference report.

Public Law 96-229
96th Congress - H. R. 2676

ENVIRONMENTAL RESEARCH, DEVELOPMENT, AND DEMONSTRATION AUTHORIZATION ACT OF 1980

94 Stat. 325 April 7, 1980

[NON-NUCLEAR HAZARDOUS WASTE DISPOSAL STUDY]

SEC. 2. (a)(7)(B) $2,100,000 is for a Hazardous Waste program of which--

(i) $300,000 shall be used for a study of non-nuclear hazardous waste disposal including consideration of the effects of such disposal on the environment, and a general review of disposal technology, alternatives to disposal, and options for containing or removing hazardous wastes already in the environment. The Administrator of the Environmental Protection Agency shall enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct this study. The ACADEMY should complete the study within eighteen months after funding arrangements have been made and make interim reports at least every six months to the Congress and the Environmental Protection Agency. The Administrator shall regularly report to the Congress on the Agency's response to the interim reports and shall deliver his recommendations for acting on the findings of the final study no later than July 1, 1981;

(ii) $300,000 shall be used to begin development of protocols and working manuals specifying the types of health problems associated with various hazardous wastes, effects of various kinds of exposure, strategies to contain releases from hazardous disposal sites, actions to be taken by on-scene response teams, and other activities deemed by the Administrator to be of urgent need in responding to hazardous waste releases; and

(iii) $1,500,000 shall be used to demonstrate cost-effective strategies for isolating, containing, or neutralizing hazardous wastes.

[94 Stat. 326 Not codified]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-58 (Committee on Science and Technology). No. 96-611 (Committee of Conference)
SENATE REPORT:	No. 96-158 (Committee on Environment and Public Works).
CONGRESSIONAL RECORD:	
Vol. 125 (1979):	Mar. 26, 27, considered and passed House. May 23, considered and passed Senate, amended. Nov. 14, Senate agreed to conference report. Nov. 29, point of order made and sustained against conference report; House receded from its disagreement and agreed to Senate amendment No. 1 with an amendment; agreed to amendments numbered 2 through 7.
Vol. 126 (1980):	Mar. 25, Senate agreed to House amendment.

Health Care Delivery

P. L. 93–112:	Rehabilitation Act of 1973 (Rehabilitation Services Administration)	103
P. L. 93–154:	Emergency Medical Services Systems Act of 1973 (Interagency Committee on Emergency Medical Services) (Includes amendment in P. L. 94–573)	105
P. L. 93–222:	Health Maintenance Organization Act of 1973 (Health Care Quality Assurance Programs Study)	107
P. L. 95–83:	Health Planning and Health Services Research and Statistics Extension Act of 1977 (International Health Activities Study)	110
P. L. 98–551:	Health Promotion and Disease Prevention Amendments of 1984 (Council on Health Care Technology)	112

Public Law 93-112
93rd Congress - H. R. 8070

REHABILITATION ACT OF 1973

87 Stat. 355 September 26, 1973

REHABILITATION SERVICES ADMINISTRATION

* * *

SEC. 3. (b) The Secretary [of Health, Education, and Welfare], through the Commissioner [of the Rehabilitation Services Administration] in coordination with other appropriate programs in the Department of Health, Education, and Welfare, in carrying out research under this Act shall establish the expertise and technological competence to, and shall, in consultation with, the National Science Foundation and the NATIONAL ACADEMY OF SCIENCES develop and support, and stimulate the development and utilization (including production and distribution of new and existing devices) of, innovative methods of applying advanced medical technology, scientific achievement, and psychological and social knowledge to solve rehabilitation problems, and be responsible for carrying out the activities described in section 202(b)(2).[*]

[87 Stat. 358 No longer codified]

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[*]SEC. 202. (b)(2) [RESEARCH AND TRAINING.] Establishment and support of Rehabilitation Engineering Research Centers to (A) develop innovative methods of applying advanced medical technology, scientific achievement, and psychological and social knowledge to solve rehabilitation problems through planning and conducting research, including cooperative research with public or private agencies and organizations, designed to produce new scientific knowledge, equipment, and devices suitable for solving problems in the rehabilitation of handicapped individuals and for reducing environmental barriers, and to (B) cooperate with State agencies designated pursuant to section 101 in developing systems of

information exchange and coordination to promote the prompt utilization of engineering and other scientific research to assist in solving problems in the rehabilitation of handicapped individuals.

[87 Stat. 375 29 U.S.C. § 762 (b)(2)]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 93-244 (Committee on Education and Labor). No. 93-500 (Committee of Conference).
SENATE REPORTS:	No. 93-318 accompanying S. 1875 (Committee on Labor and Public Welfare). No. 93-391 (Committee of Conference).
CONGRESSIONAL RECORD:	
Vol. 119 (1973):	June 5, considered and passed House. July 18, considered and passed Senate, amended, in lieu of S. 1875. Sept. 13, Senate agreed to conference report. Sept. 18, House agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 9, No. 39:	Sept. 26, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Ability Testing of Handicapped People: Dilemma for Government, Science, and the Public

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Public Law 93-154
93rd Congress - S. 2410

EMERGENCY MEDICAL SERVICES SYSTEMS ACT OF 1973

87 Stat. 594 November 16, 1973

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as amended by

Public Law 94-573
94th Congress - S. 2548

EMERGENCY MEDICAL SERVICES AMENDMENTS OF 1976

90 Stat. 2709 October 21, 1976

INTERAGENCY COMMITTEE ON EMERGENCY MEDICAL SERVICES

SEC. 1209. (b) The Secretary [of Health, Education, and Welfare] or his designee shall serve as Chairman of the Committee [Interagency Committee on Emergency Medical Services], the membership of which shall include (1) appropriate scientific, medical, or technical representation from the Department of Transportation, the Department of Justice, the Department of Defense, the Veterans' Administration, the National Science Foundation, the Federal Communications Commission, and such other Federal agencies and offices (including appropriate agencies and offices of the Department of Health, Education, and Welfare) and from the NATIONAL ACADEMY OF SCIENCES, as the Secretary determines administer programs directly affecting the functions or responsibilities of emergency medical services systems, and (2) five individuals from the general public appointed by the President from individuals who by virtue of their training or experience are particularly qualified to participate in the performance of the Committee's functions. The Committee shall meet at the call of the Chairman, but not less often than four times a year.

[87 Stat. 603 No longer codified]

AMENDMENT:

(1976) Section 10(b) of Public Law 94-573 amended section 1209(b) by inserting "and from the NATIONAL ACADEMY OF SCIENCES" after "Education, and Welfare)."

[90 Stat. 2716 No longer codified]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 93-601 accompanying H.R. 10956 (Committee on Interstate and Foreign Commerce).
SENATE REPORT:	No. 93-397 (Committee on Labor and Public Welfare).
CONGRESSIONAL RECORD: Vol. 119 (1973):	Sept. 19, considered and passed Senate. Oct. 25, considered and passed House, amended, in lieu of H.R. 10956. Oct. 30, Senate agreed to House amendment with amendments. Oct. 31, House concurred in Senate amendments.

Public Law 93-222
93rd Congress - S. 14

HEALTH MAINTENANCE ORGANIZATION ACT OF 1973

87 Stat. 914 December 29, 1973

HEALTH CARE QUALITY ASSURANCE PROGRAMS STUDY

SEC. 4. (a) The Secretary of Health, Education, and Welfare shall contract, in accordance with subsection (b), for the conduct of a study to--

(1) analyze past and present mechanisms (both required by law and voluntary) to assure the quality of health care, identify the strengths and weaknesses of current major prototypes of health care quality assurance systems, and identify on a comparable basis the costs of such prototypes;

(2) provide a set of basic principles to be followed by any effective health care quality assurance system, including principles affecting the scope of the system, methods for assessing care, data requirements, specifications for the development of criteria and standards which relate to desired outcomes of care, and means for assessing the responsiveness of such care to the needs and perceptions of the consumers of such care;

(3) provide an assessment of programs for improving the performance of health practitioners and institutions in providing high-quality health care, including a study of the effectiveness of sanctions and educational programs;

(4) define the specific needs for a program of research and evaluation in health care quality assurance methods, including the design of prospective evaluations protocols for health care quality assurance systems; and

(5) provide methods for assessing the quality of health care from the point of view of consumers of such care.

(b) The Secretary shall contract for the conduct of the study required by subsection (a) with a nonprofit private organization which--

(1) has a national reputation for objectivity in the conduct of studies for the Federal Government;

(2) has the capacity to readily marshall the widest possible range of expertise and advice relevant to the conduct of such study;

(3) has a membership and competent staff which have backgrounds in government, the health sciences, and the social sciences;

(4) has a history of interest and activity in health policy issues related to such study; and

(5) has extensive existing contracts with interested public and private agencies and organizations. The Secretary shall enter into such contract within 90 days of the date of the enactment of the first Act making an appropriation under subsection (d).

(c) An interim report providing a plan for the study required by subsection (a) shall be submitted by the organization conducting the study to the Committee on Interstate and Foreign Commerce of the House of Representatives and the Committee on Labor and Public Welfare of the Senate by June 30, 1974; and a final report giving the results of the study and providing specifications for an effective quality assurance system shall be submitted by such organization to the Committee on Interstate and Foreign Commerce of the House of Representatives and the Committee on Labor and Public Welfare of the Senate by January 31, 1976.

(d) There is authorized to be appropriated $10,000,000, which shall be available without fiscal year limitation, for the conduct of the study required by subsection (a).

[87 Stat. 934-35 42 U.S.C § 300e note]

The legislative history provides in relevant part:

It is the intention of the conferees that the INSTITUTE OF MEDICINE of the NATIONAL ACADEMY OF SCIENCES should be included among the organizations to be given an opportunity to receive a contract to conduct the study.

SENATE REPORT No. 621, 93rd Congress, 1st Session, p. 30, reprinted in 1974 U. S. CODE CONGRESSIONAL AND ADMINISTRATIVE NEWS, p. 3152.

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 93-451 accompanying H.R. 7974 (Committee on Interstate and Foreign Commerce). No. 93-714 (Committee of Conference).
SENATE REPORTS:	No. 93-129 (Committee on Labor and Public Welfare). No. 93-621 (Committee of Conference).
CONGRESSIONAL RECORD:	
Vol. 119 (1973):	May 14, 15, considered and passed Senate. Sept. 12, considered and passed House, amended, in lieu of H.R. 7974. Dec. 18, House agreed to conference report. Dec. 19, Senate agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 10, No. 1 (1974):	Dec. 29, 1973, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Assessing Quality in Health Care: An Evaluation

Public Law 95-83
95th Congress - H. R. 4975

HEALTH PLANNING AND HEALTH SERVICES RESEARCH AND STATISTICS EXTENSION ACT OF 1977

91 Stat. 383
August 1, 1977

[INTERNATIONAL HEALTH ACTIVITIES STUDY]

SEC. 315. (a)(1) The Secretary of Health, Education, and Welfare (hereinafter in this section referred to as "Secretary") shall arrange for the conduct of a study or studies to determine opportunities, if any, for broadened Federal program activities in areas of international health. Such study or studies shall consider biomedical and behavioral research, health services research, health professions education, immunization and public health activities, and other areas that might improve our and other nations' capacities to prevent, diagnose, control, or cure disease, and to organize and deliver effective and efficient health services.

(2) An interim report on such study or studies shall be completed no later than October 1, 1977. A final report thereon shall be completed no later than January 1, 1978. Both reports shall be submitted to the Secretary, the Committee on Human Resources of the Senate, and the Committee on Interstate and Foreign Commerce of the House of Representatives.

(b)(1) The Secretary shall request the NATIONAL ACADEMY OF SCIENCES (hereinafter in this section referred to as "ACADEMY") to conduct such study or studies under an arrangement whereby the actual expenses incurred by the ACADEMY directly related to the conduct of such study or studies will be paid by the Secretary. If the ACADEMY is willing to do so, the Secretary shall enter into such an arrangement with the ACADEMY.

(2) If the ACADEMY is unwilling to conduct one or more of such studies under such an arrangement, then the Secretary shall enter into a similar arrangement with other appropriate nonprofit private groups or associations to conduct such study or studies and prepare and submit the reports thereon as provided in subsection (a)(2).

[91 Stat. 398-99 42 U.S.C. § 242l note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-117. No. 95-116 accompanying H.R. 4974. No. 95-118 accompanying H.R. 4976. (All from Committee on Interstate and Foreign Commerce). No. 95-500 (Committee of Conference).
SENATE REPORTS:	No. 95-102 (Committee on Human Resources). No. 95-349 (Committee of Conference).
CONGRESSIONAL RECORD: Vol. 123 (1977):	Mar. 31, considered and passed House; H.R. 4974 and H.R. 4976 considered and passed House. May 4, considered and passed Senate, amended. May 11, House agreed to Senate amendment with an amendment. July 15, Senate agreed to conference report. July 20, House agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Strengthening U.S. Programs to Improve Health in Developing Countries

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Public Law 98-551
98th Congress - S. 771

HEALTH PROMOTION AND DISEASE PREVENTION AMENDMENTS OF 1984

98 Stat. 2815 October 30, 1984

SEC. 8. Section 309 of the Public Health Service Act...is amended to read as follows:

COUNCIL ON HEALTH CARE TECHNOLOGY

SEC. 309. (a)(1) In accordance with this section, the Secretary [of Health and Human Services] shall make grants for the planning, development, establishment, and operation of a Council on Health Care Technology. The Council shall comply with the provisions of this section.

(2)(A) The Secretary shall make an initial grant under paragraph (1) to the NATIONAL ACADEMY OF SCIENCES for the planning, development, and establishment of the Council with the membership prescribed by subsection (d)(1). The amount of such grant may not exceed $500,000 and may be made for not more than two-thirds of the cost of the planning, development, and establishment of the Council.

(B) The Secretary may not make a grant for the operation of the Council unless the application submitted to the Secretary for the grant contains written assurances from the applicant that the applicant will expend from non-Federal sources for the operation of the Council an amount equal to at least twice the amount of the grant applied for.

(b) The purposes of the Council shall include--

(1) promoting the development and application of appropriate health care technology assessments; and

(2) the review of existing health care technologies in order to identify obsolete or inappropriately used health care technologies.

(c)(1) The Council shall--

(A) serve as a clearinghouse for information on health care technologies and health care technology assessment;

(B) collect and analyze data concerning specific health care technologies;

(C) identify needs in the assessment of specific health care technologies and research on assessment methodologies;

(D) develop and evaluate criteria and methodologies for health care technology assessment;

(E) promote education, training, and technical assistance in the use of health care technology assessment methodologies and results; and

(F) stimulate, coordinate, and commission assessments of health care technologies.

(2) No funds from any grant made by the Secretary under this section for the planning, development, and establishment of the Council may be used to conduct any assessment of a health care technology.

(d)(1) For purposes of a grant for the planning, development, and establishment of the Council, the Council shall be composed of:

(A) At least ten members appointed by the NATIONAL ACADEMY OF SCIENCES from individuals who have education, training, experience, or expertise relating to the quality and cost-effectiveness of health care technologies and who are representatives of organizations of health professionals, hospitals, and other health care providers, health care insurers, employers, consumers, and manufacturers of products for health care.

(B) Three members appointed by the Secretary of Health and Human Services.

(C) The Director of the Office of Technology Assessment, who shall be an ex officio member.

(2) Any vacancy in the Council shall not affect its power and, for purposes of a grant for the planning, development, and establishment of the Council, shall be filled in the manner prescribed by paragraph (1).

(f) The President of the NATIONAL ACADEMY OF SCIENCES shall designate one of the members appointed to the initial Council under subsection (d)(1)(A) as Chairman of the Council for a one-year term. Thereafter, the members of the Council shall elect one of its members as Chairman for such terms as may be determined by the Council.

(g) The recipient of a grant under subsection (a) shall submit an annual report to the Committee on Energy and Commerce of the House of Representatives and the Committee on Labor and Human Resources of the Senate on the Council's activities.

(h) No grant may be made under this section unless an application is submitted to the Secretary in such form and containing such information as the Secretary shall prescribe.

[98 Stat. 2820-22 42 U.S.C. § 242n]

LEGISLATIVE HISTORY:

SENATE REPORT:	No. 98-158 (Committee on Labor and Human Resources).
CONGRESSIONAL RECORD:	
Vol. 129 (1983):	Sept. 21, considered and passed Senate.
Vol. 130 (1984):	Oct. 9, considered and passed House, amended. Oct. 11, Senate concurred in House amendment.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 20, No. 44 (1984):	Oct. 30, Presidential statement.

Health Manpower

P. L. 93–82: Veterans Health Care Expansion Act of 1973 (Veterans' Administration Personnel Requirements) 117

P. L. 93–233: Social Security Amendments of 1973 (Physicians' Services in Teaching Hospitals) 119

P. L. 93–348: National Research Service Award Act of 1974 (Title I of the National Research Act) (Biomedical and Behavioral Research Personnel) (Includes amendments in P. L. 94–278 and P. L. 95–622) 121

P. L. 96–76: Nursing Training Amendments of 1979 (Title I of the Public Health Service Act, Amendment) (Nursing Study) 124

P. L. 97–35: Omnibus Budget Reconciliation Act of 1981 (Physician Study) 127

Public Law 93-82
93rd Congress - S. 59

VETERANS HEALTH CARE EXPANSION ACT OF 1973

87 Stat. 179 August 2, 1973

TITLE II--AMENDMENTS...RELATING TO THE DEPARTMENT OF MEDICINE AND SURGERY

* * *

SEC. 201. Section 4101 of title 38, United States Code, is amended...as follows:

* * *

[STUDY OF PERSONNEL REQUIREMENTS]

(c)(1) Within ninety days after enactment of this subsection, the Administrator [of Veterans' Affairs], in consultation with the Chief Medical Director, is directed to conclude negotiations for an agreement with the NATIONAL ACADEMY OF SCIENCES under which such ACADEMY (utilizing its full resources and expertise) will conduct an extensive review and appraisal of personnel and other resource requirements in Veterans' Administration hospitals, clinics, and other medical facilities to determine a basis for the optimum numbers and categories of such personnel and other resources needed to insure the provision to eligible veterans of high quality care in all hospital, medical, domiciliary, and nursing home facilities. Such agreement shall provide that (A) at the earliest feasible date interim reports and the final report will be submitted by the NATIONAL ACADEMY OF SCIENCES to the Administrator, the President of the Senate, and the Speaker of the House of Representatives, and (B) the final report will be submitted no later than twenty-four months after the date of the agreement except that the Administrator, in consultation with the Chief Medical Director and after consultation with the House and Senate Committees on Veterans' Affairs, may permit an extension up to twelve additional months.

(2) Within ninety days after the submission of the final report described in subsection [(c)(1)] of this section, the Administrator

shall submit to the Senate and House Committees on Veterans' Affairs a detailed report of his views on the NATIONAL ACADEMY OF SCIENCES' findings and recommendations submitted in such report, including (A) the steps and timetable therefor (to be carried out in not less than three years) he proposes to take to implement such findings and recommendations and (B) any disagreements, and the reasons therefor, with respect to such findings and recommendations.

(3) The Administrator shall cooperate fully with the NATIONAL ACADEMY OF SCIENCES, and make available to the ACADEMY all such staff, information, records, and other assistance, and shall set aside for such purposes such sums, as are necessary to insure the success of the study.

[87 Stat. 187-8 No longer codified]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 93-368 accompanying H.R. 9048 (Committee on Veterans' Affairs).
SENATE REPORT:	No. 93-54 (Committee on Veterans' Affairs).
CONGRESSIONAL RECORD:	
Vol. 119 (1973):	Mar. 6, considered and passed Senate. July 17, considered and passed House, amended, in lieu of H.R. 9048. July 19, Senate agreed to House amendment.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 9, No. 31:	Aug. 2, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Health Care for American Veterans

Public Law 93-233
93rd Congress - H. R. 11333

SOCIAL SECURITY AMENDMENTS OF 1973

87 Stat. 947
December 31, 1973

PAYMENT FOR SERVICES OF PHYSICIANS RENDERED IN A TEACHING HOSPITAL

* * *

SEC. 15. (c)(1) The Secretary of Health, Education, and Welfare shall arrange for the conduct of a study or studies concerning (A) appropriate and equitable methods of reimbursement for physicians' services under titles XVIII and XIX of the Social Security Act in hospitals which have a teaching program approved as specified in section 1861(b)(6) of such Act, (B) the extent to which funds expended under such titles are supporting the training of medical specialties which are in excess supply, (C) how such funds could be expended in ways which support more rational distribution of physician manpower both geographically and by specialty, (D) the extent to which such funds support or encourage teaching programs which tend to disproportionately attract foreign medical graduates, and (E) the existing and appropriate role that part of such funds which are expended to meet in whole or in part the cost of salaries of interns and residents in teaching programs approved as specified in section 1861(b)(6) of such Act.

(2) The studies required by paragraph (1) shall be the subject of an interim report thereon submitted not later than December 1, 1974, and a final report not later than July 1, 1975. Such reports shall be submitted to the Secretary, the Committee on Finance of the Senate, and the Committee on Ways and Means of the House of Representatives, simultaneously.

(3) The Secretary shall request the NATIONAL ACADEMY OF SCIENCES to conduct such studies under an arrangement under which the actual expenses incurred by such ACADEMY in conducting such studies will be paid by the Secretary. If the NATIONAL ACADEMY OF SCIENCES is willing to do so, the Secretary shall enter into such an arrangement with such ACADEMY for the conduct of such studies.

(4) If the NATIONAL ACADEMY OF SCIENCES is unwilling to conduct the studies required under this section, under such an arrangement with the Secretary, then the Secretary shall enter into a similar arrangement with other appropriate nonprofit private groups or associations under which such groups or associations shall conduct such studies and prepare and submit the reports thereon as provided in paragraph (2).

(5) The Social Security Administration shall study the interim report called for in paragraph (2) and shall submit its analysis of such interim report to the Committee on Finance of the Senate and the Committee on Ways and Means of the House of Representatives not later than March 1, 1975. The Social Security Administration shall study and submit its analysis of the final report to the Committee on Finance of the Senate and the Committee on Ways and Means of the House of Representatives by October 1, 1975.

[87 Stat. 966 42 U.S.C. § 1395x note]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 93-627 (Committee on Ways and Means).
CONGRESSIONAL RECORD:	
Vol. 119 (1973):	Nov. 13-15, considered and passed House.
	Dec. 20, 21, considered and passed Senate, amended.
	Dec. 21, House agreed to Senate amendment.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 10, No. 1 (1974):	Jan. 3, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Medicare-Medicaid Reimbursement Policies

Public Law 93-348
93rd Congress - H. R. 7724

NATIONAL RESEARCH SERVICE AWARD ACT OF 1974 (TITLE I OF THE NATIONAL RESEARCH ACT)

88 Stat. 342 July 12, 1974

as amended by

Public Law 94-278
94th Congress - H. R. 7988

HEALTH RESEARCH AND HEALTH SERVICES AMENDMENTS OF 1976

90 Stat. 401 April 22, 1976

and

Public Law 95-622
95th Congress - S. 2450

BIOMEDICAL RESEARCH AND RESEARCH TRAINING AMENDMENTS OF 1978 (TITLE II OF COMMUNITY MENTAL HEALTH CENTERS ACT, AMENDMENTS)

92 Stat. 3420 November 9, 1978

STUDIES RESPECTING BIOMEDICAL AND BEHAVIORAL RESEARCH PERSONNEL

SEC. 473. (a) The Secretary [of Health, Education, and Welfare] shall, in accordance with subsection (b), arrange for the conduct of a continuing study to--

(1) establish (A) the Nation's overall need for biomedical and behavioral research personnel, (B) the subject areas in which such personnel are needed and the number of such personnel needed in each such area, and (C) the kinds and extent of training which should be provided such personnel;

(2) assess (A) current training programs available for the training of biomedical and behavioral research personnel which are conducted under this Act at or through institutes under the National Institutes of Health and the Alcohol, Drug Abuse, and Mental Health Administration, and (B) other current training programs available for the training of such personnel;

(3) identify the kinds of research positions available to and held by individuals completing such programs;

(4) determine, to the extent feasible, whether the programs referred to in clause (B) of paragraph (2) would be adequate to meet the needs established under paragraph (1) if the programs referred to in clause (A) of paragraph (2) were terminated; and

(5) determine what modifications in the programs referred to in paragraph (2) are required to meet the needs established under paragraph (1).

(b)(1) The Secretary shall request the NATIONAL ACADEMY OF SCIENCES to conduct the study required by subsection (a) under an arrangement under which the actual expenses incurred by such ACADEMY in conducting such study will be paid by the Secretary. If the NATIONAL ACADEMY OF SCIENCES is willing to do so, the Secretary shall enter into such an arrangement with such ACADEMY for the conduct of such a study.

(2) If the NATIONAL ACADEMY OF SCIENCES is unwilling to conduct such study under such an arrangement, then the Secretary shall enter into a similar arrangement with other appropriate nonprofit private groups or associations under which such groups or associations will conduct such study and prepare and submit the reports thereon as provided in subsection (c).

(3) The NATIONAL ACADEMY OF SCIENCES or other group or association conducting the study required by subsection (a) shall conduct such study in consultation with the Director of the National Institutes of Health.

(c) A report on the results of such study shall be submitted by the Secretary to the Committee on Interstate and Foreign Commerce of the House of Representatives and the Committee on Labor and Public Welfare of the Senate at least once every two years.

[88 Stat. 345-46 42 U.S.C. § 289l-2]

AMENDMENTS:

(1976) Section 204 of Public Law 94-278 amended section 473(b) by adding subsection (b)(3).

[90 Stat. 406 42 U.S.C. § 289l-2]

(1976) Section 205 of Public Law 94-278 amended section 473(c) by substituting "September 30 of each year" for "March 31 of each year."

[90 Stat. 406 42 U.S.C. § 289l-2]

(1978) Section 256 of Public Law 95-622 amended section 473(c) by substituting "at least once every two years." for "not later than September 30 of each year."

[92 Stat. 3434 42 U.S.C. § 289l-2]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 93-224 (Committee on Interstate and Foreign Commerce). No. 93-1148 (Committee of Conference).
SENATE REPORT:	No. 93-381 (Committee on Labor and Public Welfare).
CONGRESSIONAL RECORD:	
Vol. 119 (1973):	May 31, considered and passed House. Sept. 11, considered and passed Senate, amended.
Vol. 120 (1974):	June 27, Senate agreed to conference report. June 28, House agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Personnel Needs and Training for Biomedical and Behavioral Research

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Public Law 96-76
96th Congress - S. 230

NURSE TRAINING AMENDMENTS OF 1979
(TITLE I OF THE PUBLIC HEALTH SERVICE ACT, AMENDMENT)

93 Stat. 579 September 29, 1979

[NURSING STUDY]

SEC. 113. (a)(1) The Secretary of Health, Education, and Welfare (hereinafter in this section referred to as the "Secretary") shall arrange, in accordance with subsection (b), for the conduct of a study--

(A) to determine the need to continue a specific program of Federal financial support for nursing education,

(B) to determine the reasons nurses do not practice in medically underserved areas and to develop recommendations for actions which could be taken to encourage nurses to practice in such areas, and

(C) to determine the rate at which and the reasons for which nurses leave the nursing profession and to develop recommendations for actions which could be taken to encourage nurses to remain or re-enter the nursing profession, including actions involving practice settings conducive to the retention of nurses.

(2) The part of the study described in paragraph (1)(A), shall include consideration of the following:

(A) The need for nurses under the present health care delivery system and under such system as it may be modified by increased use of ambulatory care facilities or as it may be changed by the enactment of legislation for national health insurance. Determination of such need shall include determination of the need for nurses trained in each type of school of nursing (as defined in section 853(2) of the Public Health Service Act), for nurses with graduate training in the varying nurse practitioner clinical specialties, and for nurse administrators and nurse educators.

(B) The cost of nursing education and a comparison of the cost of education at each type of school of nursing (as so defined) and comparison of the cost of each of the graduate programs of nursing.

(C) The availability of other sources of support for nursing education, including support under general programs of Federal financial support for postsecondary education, under State and other public programs, and from private sources.

(b)(1) The Secretary shall first request the NATIONAL ACADEMY OF SCIENCES (hereinafter in this section referred to as the "ACADEMY"), acting through the INSTITUTE OF MEDICINE, to conduct the study, required by subsection (a) under an arrangement whereby the actual expenses incurred by the ACADEMY directly related to the conduct of such study will be paid by the Secretary. If the ACADEMY agrees to such request, the Secretary shall enter into such an agreement with the ACADEMY.

(2) If the ACADEMY declines the Secretary's request to conduct such study under such an arrangement, then the Secretary, after consulting with the Committee on Labor and Human Resources of the Senate and the Committee on Interstate and Foreign Commerce of the House of Representatives, shall enter into a similar arrangement with another appropriate public or nonprofit private entity to conduct such study.

(3) Any arrangement entered into under paragraph (1) or (2) of this subsection for the conduct of a study shall require that such study be completed and reports thereon be submitted within such period as the Secretary may require to meet the requirements of subsection (c).

(4) The Secretary shall undertake such preliminary activities as may be necessary to enable the Secretary to enter into an arrangement for the conduct of the study at the earliest possible date.

(c) Not later than six months after the date the arrangement for the conduct of the study is entered into under subsection (b), the Secretary and the entity conducting the study shall each report to the Committee on Human Resources of the Senate and the Committee on Interstate and Foreign Commerce of the House of Representatives their respective preliminary recommendations respecting the matters described in subparagraphs (A), (B), and (C) of subsection (a)(1) and, if a need for continued Federal financial support for nursing is found, the form in which the support should be provided. Not later than two years after such date, the Secretary and the entity which conducted the study shall each report to such Committees recommendations respecting such matters (including the form of Federal financial support for nursing) and the basis for such recommendations.

[93 Stat. 581 42 U.S.C. § 296 note]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 96-183 accompanying H.R. 3633 (Committee on Interstate and Foreign Commerce).
SENATE REPORT:	No. 96-101 (Committee on Labor and Human Resources).
CONGRESSIONAL RECORD: Vol. 125 (1979):	May 7, considered and passed Senate. July 23, 27, H.R. 3633 considered and passed House; passage vacated and S. 230, amended, passed in lieu. Sept. 7, Senate agreed to conference report. Sept. 20, House agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Nursing and Nursing Education: Public Policies and Private Actions

Public Law 97-35
97th Congress - H. R. 3982

OMNIBUS BUDGET RECONCILIATION ACT OF 1981

95 Stat. 357 August 31, 1981

TITLE XXVII--NATIONAL HEALTH SERVICE CORPS; HEALTH PROFESSIONS EDUCATION; NURSE TRAINING

* * *

CHAPTER 2--HEALTH PROFESSIONS TRAINING

* * *

PHYSICIAN STUDY

SEC. 2747. (a) The Secretary of Health and Human Services shall arrange, in accordance with subsection (c), for a study to determine--

(1) the implications of the increase in the supply of physicians and the projected distribution of the increased number of physicians in the various medical specialties for--

(A) the cost of health care,

(B) the distribution of all physicians by geographic area, and

(C) the quality of health care; and

(2) the implications of the patterns of payments of physicians by Federal and other public and private third-party payers (including differences in the levels of payments to physicians in various medical specialties and geographic areas and differences in the amount of payments which support post-graduate training programs in such specialties) for--

(A) the distribution of physicians in the various medical specialties,

(B) the cost of health care,

(C) the distribution of physicians by geographic area, and

(D) the quality of health care.

(b) An interim report on such study shall be completed not later than March 30, 1983. Such interim report shall include an analysis of the most effective means of providing financial assistance to graduate medical education in the United States in general internal medicine, general pediatrics, and family medicine, with particular attention to identifying ways of reducing or eliminating the need for special Federal financial assistance for such programs. A final report of such study shall be completed not later than September 30, 1984. Both reports shall be submitted to the Secretary, the Committee on Labor and Human Resources of the Senate, and the Committee on Energy and Commerce of the House of Representatives.

(c)(1) The Secretary shall enter into a contract with the INSTITUTE OF MEDICINE of the NATIONAL ACADEMY OF SCIENCES to conduct the study described in subsection (a). If the INSTITUTE OF MEDICINE is unwilling to enter into a contract to conduct such study, then the Secretary shall enter into a contract with another appropriate nonprofit private entity to conduct such study and prepare and submit the reports thereon as provided in subsection (b).

[95 Stat. 928-29 42 U.S.C. § 292h note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 97-158, vols. I-III (Committee on the Budget). No. 97-208, bks. 1, 2 (Committee of Conference).
SENATE REPORT:	No. 97-139 accompanying S. 1377 (Committee on the Budget).
CONGRESSIONAL RECORD: Vol. 127 (1981):	June 22-25, S. 1377 considered and passed Senate. June 25-26, considered and passed House. July 13, considered and passed Senate, amended, in lieu of S. 1377. July 31, House and Senate agreed to conference report.

Health Research

P. L. 94–562: Arthritis, Diabetes, and Digestive Disease Amendments of 1976 (Digestive Diseases Coordinating Committee) 131

P. L. 96–538: Health Programs Extension Act of 1980 (Neurological Research) 133

P. L. 98–63: Supplemental Appropriations Act, 1983 (Trauma Research) 135

P. L. 98–78: Department of Transportation and Related Agencies Appropriations Act, 1983 (Appropriation for Trauma Research) 137

P. L. 98–460: Social Security Disability Benefits Reform Act of 1984 (Evaluation of Pain) 139

Public Law 94-562
94th Congress - S. 2910

ARTHRITIS, DIABETES, AND DIGESTIVE DISEASE AMENDMENTS OF 1976

90 Stat. 2645

October 19, 1976

TITLE III--DIGESTIVE DISEASES

* * *

SEC. 302. Part D. of title IV [of the Public Health Service Act] is amended by adding after section 440 (as added by section 103 of this Act) the following new section:

COORDINATING COMMITTEE FOR DIGESTIVE DISEASES

SEC. 440A. (a) The Secretary [of Health, Education, and Welfare] shall establish a Coordinating Committee for Digestive Diseases (hereafter in this section referred to as the "Committee") to be composed of the Directors (or their designated representatives) of each of the Institutes of the National Institutes of Health involved in digestive disease research; and the head (or his designated representative) of the Alcohol, Drug Abuse and Mental Health Administration, the National Institute of Occupational Safety and Health, the Food and Drug Administration, the Department of Medicine and Surgery of the Veterans' Administration, the Center for Disease Control, the Department of Defense, the Department of Agriculture, the Health Services Administration, the Health Resources Administration, the Social Security Administration, and the INSTITUTE OF MEDICINE of the NATIONAL ACADEMY OF SCIENCES. The Committee shall be chaired by the Director of the National Institute of Arthritis, Metabolism, and Digestive Diseases and the Associate Director for Digestive Diseases and Nutrition of that Institute shall serve as vice chairman. The Committee shall meet at the call of the Chairman, but not less often than three times a year.

(b) The Committee shall be responsible for the coordination of the activities of the entities represented on the Committee respecting digestive diseases. The Committee shall submit to the

Secretary an annual report detailing the manner in which the Committee has coordinated such activities.

[90 Stat. 2653 No longer codified]

LEGISLATIVE HISTORY:

CONGRESSIONAL RECORD:

Vol. 122 (1976):	Oct. 1, considered and passed Senate and House.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:

Vol. 12, No. 43:	Oct. 20, Presidential statement.

Public Law 96-538
96th Congress - S. 988

HEALTH PROGRAMS EXTENSION ACT OF 1980

94 Stat. 3183 December 17, 1980

TITLE V--NEUROLOGICAL RESEARCH

SEC. 501. (a) The Secretary of Health and Human Services shall enter into a contract, in accordance with subsection (b), with a private, nonprofit entity pursuant to which such entity shall--

(1) conduct a general review of past and ongoing neurological research;

(2) include, in the review described in paragraph (1), a review of past and ongoing research regarding spinal cord regeneration following acute and chronic damage to the spinal cord;

(3) identify those areas of neurological research which appear to be the most promising;

(4) prepare an outline of a 5-year plan for neurological research, including (A) recommendations regarding the resources needed to effectively implement such a plan, and (B) specific recommendations with respect to spinal cord regeneration research; and

(5) transmit to the Secretary a report summarizing its findings and recommendations.

(b) The Secretary shall enter into the contract described in subsection (a) with the INSTITUTE OF MEDICINE of the NATIONAL ACADEMY OF SCIENCES, except that, if the INSTITUTE OF MEDICINE of the NATIONAL ACADEMY OF SCIENCES declines to enter into such contract after a reasonable period of time determined by the Secretary, the Secretary shall enter into such contract with any other private, nonprofit entity which the Secretary has determined is qualified to carry out the terms of such contract.

(c) The report described in subsection (a)(5) shall be transmitted to the Secretary no later than 12 months after the date of the enactment of this Act.

(d) The authority of the Secretary to enter into a contract under this section shall be effective for any fiscal year only to such extent or in such amounts as are provided in advance by appropriation Acts.

[94 Stat. 3192 42 U.S.C. § 289 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-997 accompanying H.R. 7036 (Committee on Interstate and Foreign Commerce). No. 96-1478 (Committee of Conference).
SENATE REPORT:	No. 96-714 (Committee on Labor and Human Resources).
CONGRESSIONAL RECORD: Vol. 126 (1980):	June 19, considered and passed Senate. Aug. 28, H.R. 7036 considered and passed House; passage vacated and S. 988, amended, passed in lieu. Dec. 1, Senate agreed to conference report. Dec. 4, House agreed to conference report.

Public Law 98-63
98th Congress - H. R. 3069

SUPPLEMENTAL APPROPRIATIONS ACT, 1983

97 Stat. 301 July 30, 1983

The legislative history of the Act provides in relevant part:

SUPPLEMENTAL APPROPRIATIONS BILL

* * *

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

* * *

TRAUMA RESEARCH

Trauma is the number one killer and maimer of people between the ages of 1 and 44. Every year trauma kills over 150,000 people and leaves 10 to 17 million victims disabled. Motor vehicle fatalities are the largest single component of this toll, accounting for approximately one-third of the total. The committee is deeply concerned that, while trauma is a major public health and transportation safety problem, there exists no systematic, coordinated approach aimed at attacking this problem. According to recent testimony received by the committee, 27 different Government agencies including NHTSA were pursuing trauma-related research in 1980. The committee fears that this diffusion of responsibility has resulted in duplication, omission, and lack of adequate priority planning to address all aspect of prevention, treatment, and rehabilitation of trauma injuries. This clearly is a fertile field for significantly reducing the deaths and injuries on our Nation's highways.

The committee directs the National Highway Traffic Safety Administration to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to examine the need for a comprehensive Federal approach to combat the threat of trauma to the American people. This report should review current Federal trauma research efforts; identify gaps, deficiencies, and duplication in those activities; and explain the benefits that could be realized from a systematic, comprehensive approach to trauma research. This report should also contain recommendations as to how to institutionalize a national center designed to systematically conduct research on the prevention, treatment, and rehabilitation of trauma. This study should include input from physicians, public health officers, engineers, researchers, educators, and representatives of industry and philanthropic organizations.

This report should be submitted to Congress not later than March 31, 1984.

HOUSE REPORT No. 98-207, 98th Congress, 1st Session, p. 84 (1983).

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 98-207 (Committee on Appropriations). No. 98-308 (Committee of Conference).
SENATE REPORT:	No. 98-148 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 129 (1983):	May 25, considered and passed House. June 9, 10, 14-16, considered and passed Senate, amended. July 28, House agreed to conference report. July 29, House concurred in certain Senate amendments and in others with amendments, and insisted on its disagreement to certain Senate amendments. Senate agreed to conference report, concurred in House amendments, and receded from its amendments in disagreement.

REPORT RESULTING FROM THIS LEGISLATION:

Injury in America: A Continuing Public Health Problem

Public Law 98-78
98th Congress - H. R. 3329

DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS ACT, 1983

97 Stat. 453 August 15, 1983

The legislative history of the Act provides in relevant part:

DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATION BILL, 1984

TITLE I—DEPARTMENT OF TRANSPORTATION

* * *

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

* * *

RESEARCH AND ANALYSIS

* * *

The Committee has included $800,000 in addition to the Administration's request for crashworthiness research to finance important activities aimed at reducing the harm associated with vehicle crashes. Of this sum, $550,000 should be dedicated to biomechanics research, of which not to exceed $350,000 should be used to finance the study on trauma research required in the Committee's report accompanying the fiscal year 1983 Supplemental Appropriation Bill. The additional $200,000 for biomechanics research should be used to improve the agency's basic understanding of human injury tolerance levels.

HOUSE REPORT No. 98-246, 98th Congress, 1st Session, p. 54 (1983).

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 98-318 (Committee of Conference).
SENATE REPORT:	No. 98-179 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 129 (1983):	June 22, considered and passed House. July 15, considered and passed Senate, amended. Aug. 2, House agreed to conference report; concurred in certain amendments and in others with amendments, and insisted on others. Aug. 3, Senate agreed to conference report; concurred in certain House amendments, in another with an amendment, and receded from an amendment. Aug. 4, House concurred in Senate amendment.

REPORT RESULTING FROM THIS LEGISLATION:

Injury in America: A Continuing Public Health Problem

Public Law 98-460
98th Congress - H. R. 3755

SOCIAL SECURITY DISABILITY BENEFITS REFORM ACT OF 1984

98 Stat. 1794 October 9, 1984

EVALUATION OF PAIN

SEC. 3 (a)(1) Section 223(d)(5) of the Social Security Act is amended by inserting after the first sentence the following new sentences: "An individual's statement as to pain or other symptoms shall not alone be conclusive evidence of disability as defined in this section; there must be medical signs and findings, established by medically acceptable clinical or laboratory diagnostic techniques, which show the existence of a medical impairment that results from anatomical, physiological, or psychological abnormalities which could reasonably be expected to produce the pain or other symptoms alleged and which, when considered with all evidence required to be furnished under this paragraph (including statements of the individual or his physician as to the intensity and persistence of such pain or other symptoms which may reasonably be accepted as consistent with the medical signs and findings), would lead to a conclusion that the individual is under a disability. Objective medical evidence of pain or other symptoms established by medically acceptable clinical or laboratory techniques (for example, deteriorating nerve or muscle tissue) must be considered in reaching a conclusion as to whether the individual is under a disability."

(2) Section 1614(a)(3)(H) of such Act (as added by section 8 of this Act) is amended by striking out "section 221(h)" and inserting in lieu thereof "sections 221(h) and 223(d)(5)."

(3) The amendments made by paragraphs (1) and (2) shall apply to determinations made prior to January 1, 1987.

(b)(1) The Secretary of Health and Human Services shall appoint a Commission on the Evaluation of Pain (hereafter in this section referred to as the "Commission") to conduct a study concerning the evaluation of pain in determining under titles II and XVI of the Social Security Act whether an individual is under a disability. Such study shall be conducted in consultation with the NATIONAL ACADEMY OF SCIENCES.

(2) The Commission shall consist of at least twelve experts, including a significant representation from the field of medicine who

are involved in the study of pain, and representation from the fields of law, administration of disability insurance programs, and other appropriate fields of expertise.

(3) The Commission shall be appointed by the Secretary of Health and Human Services (without regard to the requirements of the Federal Advisory Committee Act) within 60 days after the date of the enactment of this Act. The Secretary shall from time to time appoint one of the members to serve as Chairman. The Commission shall meet as often as the Secretary deems necessary.

(4) Members of the Commission shall be appointed without regard to the provisions of title 5, United States Code, governing appointments in the competitive service. Members who are not employees of the United States, while attending meetings of the Commission or otherwise serving on the business of the Commission, shall be paid at a rate equal to the per diem equivalent of the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code, for each day, including traveltime, during which they are engaged in the actual performance of duties vested in the Commission. While engaged in the performance of such duties away from their homes or regular places of business they may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code, for persons in the Government service employed intermittently.

(5) The Commission may engage such technical assistance from individuals skilled in medical and other aspects of pain as may be necessary to carry out its functions. The Secretary shall make available to the Commission such secretarial, clerical, and other assistance and any pertinent data prepared by the Department of Health and Human Services as the Commission may require to carry out its functions.

(6) The Secretary shall submit the results of the study under paragraph (1), together with any recommendations, to the Committee on Ways and Means of the House of Representatives and the Committee on Finance of the Senate not later than December 31, 1985. The Commission shall terminate at the time such results are submitted.

[98 Stat. 1799-1800 42 U.S.C. § 423 and note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 98-618 (Committee on Ways and Means). No. 98-1039 (Committee of Conference).

SENATE REPORT:	No. 98-466 accompanying S. 476 (Committee on Finance).
CONGRESSIONAL RECORD:	
Vol. 130 (1984):	Mar. 27, considered and passed House.
	May 22, considered and passed Senate, amended, in lieu of S. 476.
	Sept. 19, House and Senate agreed to Conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 20, No. 41 (1984):	Oct. 9, Presidential statement.

Land and Resource Management

P. L. 93–251: Water Resources Development Act of 1974 (Washington Metropolitan Area Water Resource Needs Study) 145

P. L. 95–87: Surface Mining Control and Reclamation Act of 1977 (Includes amendment in P. L. 95–617) 148

P. L. 95–514: Public Rangelands Improvement Act of 1978 (Wild Horses and Burros) 153

P. L. 97–341: Capitol Reef National Park, Grazing Phaseout Study 155

P. L. 98–409: State Mining and Mineral Resources Research Institute Program 157

P. L. 98–425: California Wilderness Act of 1984 (Mono Basin National Forest Scenic Area) 160

P. L. 98–473: Department of the Interior and Related Agencies Appropriations Act, 1985 (Wild Horse and Burro Levels) 162

(See also P. L. 92–522 under MARINE SCIENCES)

Public Law 93-251
93rd Congress - H. R. 10203

WATER RESOURCES DEVELOPMENT ACT OF 1974

88 Stat. 12 March 7, 1974

[WASHINGTON METROPOLITAN AREA WATER RESOURCE NEEDS STUDY]

SEC. 85. (a) The projects for Verona Dam and Lake, Virginia, and for Sixes Bridge Dam and Lake, Maryland, are hereby authorized substantially in accordance with the recommendations of the Secretary of the Army in House Document Numbered 91-343 as modified by the recommendations of the Chief of Engineers in his report dated July 13, 1973, except that such authorization shall be limited to the phase I design memorandum of advanced engineering and design, at an estimated cost of $1,400,000.

(b)(1) Prior to any further authorization of such Sixes Bridge Dam Project, the Secretary of the Army, acting through the Chief of Engineers shall (A) make a full and complete investigation and study of the future water resources needs of the Washington metropolitan area, including but not limited to the adequacy of present water supply, nature of present and future uses, the effect water pricing policies and use restrictions may have on future demand, the feasibility of utilizing water from the Potomac estuary, all possible water impoundment sites, natural and recharged ground water supply, wastewater reclamation, and the effect such projects will have on fish, wildlife, and present beneficial uses, and shall provide recommendations based on such investigation and study for supplying such needs, and (B) report to the Congress the results of such investigation and study together with such recommendations. The study of measures to meet the water supply needs of the Washington metropolitan area shall be coordinated with the Northeastern United States water supply study authorized by the Act of October 27, 1965 (79 Stat. 1073).

(2) The Secretary of the Army, acting through the Chief of Engineers, shall undertake an investigation and study of the use of estuary waters to determine the feasibility of using such waters as a source of water supply and is authorized to construct, operate, and evaluate a pilot project on the Potomac estuary for the treatment of such waters at an estimated cost of $6,000,000. The Secretary of the Army, acting through the Chief of Engineers, shall report to the

Congress on the results of such project within three years after commencement of operation of such project and such report shall include the results of two years testing at the pilot project for the treatment of water from the Potomac estuary.

(3) The Secretary of the Army, acting through the Chief of Engineers, shall request the NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING to review and by written report comment upon the scientific basis for the conclusions reached by the investigation and study of the future water resource needs of the Washington metropolitan area and the pilot project for the treatment of water from the Potomac estuary. Such review and written report shall be completed and submitted to the Congress within one year following the completion of both the Corps of Engineers report on the future water resource needs of the Washington metropolitan area and the report on the results derived from the pilot project for the treatment of water from the Potomac estuary. Completion of such review and written report by the NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING shall be a condition of further authorization of such Sixes Bridge Dam Project.

(4) The Secretary of the Army is authorized to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING for the purpose of this subsection.

(c) There is authorized $1,000,000 for the purposes of carrying out the provisions contained in paragraph (3) of subsection (b).

[88 Stat. 36-37 Not codified]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 93-541 (Committee on Public Works). No. 93-796 (Committee of Conference).
SENATE REPORTS:	No. 93-615 accompanying S. 2798. No. 93-6 accompanying S. 606 (Committee on Public Works).

CONGRESSIONAL RECORD:

Vol. 119 (1973):	Jan. 31, Feb. 1, S. 606 considered and passed Senate. Oct. 12, considered and passed House.
Vol. 120 (1974):	Jan. 21, 22, considered and passed Senate, amended, in lieu of S. 2798. Feb. 19, House agreed to conference report. Feb. 21, Senate agreed to conference report.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:

Vol. 10, No. 10:	Mar. 7, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

The Potomac Estuary Experimental Water Treatment Plant

Public Law 95-87
95th Congress - H. R. 2

SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977

91 Stat. 445 August 3, 1977

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as amended by

Public Law 95-617
95th Congress - H. R. 4018

PUBLIC UTILITY REGULATORY POLICIES ACT OF 1978

92 Stat. 3117 November 9, 1978

TITLE III--STATE MINING AND MINERAL RESOURCES AND RESEARCH INSTITUTES

* * *

ADVISORY COMMITTEE

SEC. 309. (a) The Secretary of the Interior shall appoint an Advisory Committee on Mining and Mineral Research composed of--

(1) the Director, Bureau of Mines, or his delegate, with his consent;

(2) the Director of the National Science Foundation, or his delegate, with his consent;

(3) the President, NATIONAL ACADEMY OF SCIENCES, or his delegate, with his consent;

(4) the President, NATIONAL ACADEMY OF ENGINEERING, or his delegate, with his consent;

(5) the Director, United States Geological Survey, or his delegate, with his consent; and

(6) not more than four other persons who are knowledgeable in the fields of mining and mineral resources research, at least one of whom shall be a representative of working coal miners.

(b) The Secretary shall designate the Chairman of the Advisory Committee. The Advisory Committee shall consult with, and make recommendations to, the Secretary of the Interior on all matters involving or relating to mining and mineral resources research and such determinations as provided in this title. The Secretary of the Interior shall consult with, and consider recommendations of such Committee in the conduct of mining and mineral resources research and the making of any grant under this title.

[91 Stat. 455-56 30 U.S.C. § 1229]

TITLE VII--ADMINISTRATIVE AND MISCELLANEOUS PROVISIONS

* * *

ALASKAN SURFACE COAL MINE STUDY

SEC. 708. (a) The Secretary is directed to contract to such extent or in such amounts as are provided in advance in appropriation Acts with the NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING for an in-depth study of surface coal mining conditions in the State of Alaska in order to determine which, if any, of the provisions of this Act should be modified with respect to surface coal mining operations in Alaska.

(b) The Secretary shall report on the findings of the study to the President and Congress no later than two years after the date of enactment of this Act.

(c) The Secretary shall include in his report a draft of legislation to implement any changes recommended to this Act.

(d) Until one year after the Secretary has made this report to the President and Congress, or three years after the date of enactment of this Act, whichever comes first, the Secretary is authorized to modify the applicability of any environmental protection provision of this Act, or any regulation issued pursuant thereto, to any surface coal mining operation in Alaska from which coal has been mined during the year preceding the enactment of this Act, if he determines that it is necessary to insure the continued operation of such surface coal mining operation. The Secretary may exercise this authority only after he has (1) published notice of proposed modification in the Federal Register and in a newspaper of general circulation in the area of Alaska in which the affected surface coal mining operation is located, and (2) held a public hearing on the proposed modification in Alaska.

(e) In order to allow new mines in Alaska to continue orderly development, the Secretary is authorized to issue interim regulations pursuant to section 501(b) of this title including those modifications to the environmental standards as required based on the special physical, hydrological and climatic conditions in Alaska but with the purpose of protecting the environment to an extent equivalent to those standards for the other coal regions.

(f) There is hereby authorized to be appropriated for the purpose of this section $250,000: Provided, That no new budget authority is authorized to be appropriated for fiscal year 1977.

[91 Stat. 521-22 30 U.S.C. § 1298]

STUDY OF RECLAMATION STANDARDS FOR SURFACE MINING OF OTHER MINERALS

SEC. 709. (a) The Chairman of the Council on Environmental Quality is directed to contract to such extent or in such amounts as are provided in appropriation Acts with the NATIONAL ACADEMY OF SCIENCES-NATIONAL ACADEMY OF ENGINEERING, other Government agencies or private groups as appropriate, for an in-depth study of current and developing technology for surface and open pit mining and reclamation for minerals other than coal designed to assist in the establishment of effective and reasonable regulation of surface and open pit mining and reclamation for minerals other than coal. The study shall--

(1) assess the degree to which the requirements of this Act can be met by such technology and the costs involved;

(2) identify areas where the requirements of this Act cannot be met by current and developing technology;

(3) in those instances describe requirements most comparable to those of this Act which could be met, the costs involved, and the differences in reclamation results between these requirements and those of this Act; and

(4) discuss alternative regulatory mechanisms designed to insure the achievement of the most beneficial postmining land use for areas affected by surface and open pit mining.

(b) The study together with specific legislative recommendations shall be submitted to the President and the Congress no later than eighteen months after the date of enactment of this Act; Provided, That, with respect to surface or open pit mining for sand and gravel the study shall be submitted no later than twelve months after the date of enactment of this Act; Provided further, That with respect to mining for oil shale and tar sands that a preliminary report shall be submitted no later than twelve months after the date of enactment of this Act.

(c) There are hereby authorized to be appropriated for the purpose of this section $500,000: Provided, That no new budget authority is authorized to be appropriated for fiscal year 1977.

[91 Stat. 522-23 30 U.S.C. § 1299]

TITLE VIII—UNIVERSITY COAL RESEARCH LABORATORIES

ESTABLISHMENT

SEC. 801. (a) The Secretary of Energy, after consultation with the NATIONAL ACADEMY OF ENGINEERING, shall designate thirteen institutions of higher education at which university coal research laboratories will be established and operated. Ten such designations shall be made as provided in subsection (e) and the remaining three shall be made in fiscal year 1980.

[91 Stat. 526 30 U.S.C. § 1311]

ADVISORY COUNCIL ON COAL RESEARCH

SEC. 805. (a) There is established an Advisory Council on Coal Research which shall be composed of--

(1) the Administrator, ERDA [Energy Research and Development Administration], who shall be Chairman;

(2) the Director of the Bureau of Mines of the Department of the Interior;

(3) the President of the NATIONAL ACADEMY OF SCIENCES;

(4) the President of the NATIONAL ACADEMY OF ENGINEERING;

(5) the Director of the United States Geological Survey; and

(6) six members appointed by the Administrator from among individuals who, by virtue of experience or training, are knowledgeable in the field of coal research and mining, and who are representatives of institutions of higher education, industrial users of coal and coal-derived fuels, the coal industry, mine workers, nonindustrial consumer groups, and institutions concerned with the preservation of the environment.

(b) The Advisory Council shall advise the Administrator with respect to the general administration of this title, and furnish such additional advice as he may request.

(c) The Advisory Council shall make an annual report of its findings and recommendations (including recommendations for changes in the provisions of this title) to the President not later than December 31 of each calendar year. The President shall transmit each such report to the Congress.

[91 Stat. 528-29 30 U.S.C. § 1315]

AMENDMENT:

(1978) Section 604 of Public Law 95-617 amended Section 801(a) by changing the number of institutions from ten to thirteen and by adding the last sentence of the section.

[92 Stat. 3166 30 U.S.C. § 1311]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-218 (Committee on Interior and Insular Affairs).
	No. 95-493 (Committee of Conference).
SENATE REPORTS:	No. 95-128 accompanying S. 7 (Committee on Energy and Natural Resources).
	No. 95-337 (Committee on Conference).
CONGRESSIONAL RECORD:	
Vol. 123 (1977):	Apr. 28, 29, considered and passed House.
	May 19, S. 7 considered in Senate.
	May 20, considered and passed Senate, amended, in lieu of S. 7.
	July 20, Senate agreed to conference report.
	July 21, House agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 13, No. 32:	Aug. 3, Presidential statement.

REPORTS RESULTING FROM THIS LEGISLATION:

Surface Coal Mining in Alaska

Surface Mining of Non-Coal Minerals

Criteria for Establishing University Coal Research Laboratories

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Public Law 95-514
95th Congress - H. R. 10587

PUBLIC RANGELANDS IMPROVEMENT ACT OF 1978

92 Stat. 1803 October 25, 1978

WILD HORSES AND BURROS

SEC. 14. (a) Subsection 3(b)...of the Act of December 15, 1971...[is] hereby amended to read as follows:

SEC. 3. (b)(1) The Secretary of the Interior shall maintain a current inventory of wild free-roaming horses and burros on given areas of the public lands. The purpose of such inventory shall be to: make determinations as to whether and where an overpopulation exists and whether action should be taken to remove excess animals; determine appropriate management levels of wild free-roaming horses and burros on these areas of the public lands; and determine whether appropriate management levels should be achieved by the removal or destruction of excess animals, or other options (such as sterilization, or natural controls on population levels). In making such determinations, the Secretary shall consult with the United States Fish and Wildlife Service, wildlife agencies of the State or States wherein wild free-roaming horses and burros are located, such individuals independent of Federal and State government as have been recommended by the NATIONAL ACADEMY OF SCIENCES, and such other individuals whom he determines have scientific expertise and special knowledge of wild horse and burro protection, wildlife management and animal husbandry as related to rangeland management.

* * *

(b)(3) For the purpose of furthering knowledge of wild horse and burro population dynamics and their interrelationship with wildlife, forage and water resources, and assisting him in making his determination as to what constitutes excess animals, the Secretary shall contract for a research study of such animals with such individuals independent of Federal and State government as may be recommended by the NATIONAL ACADEMY OF SCIENCES for having scientific expertise and special knowledge of wild horse and burro protection, wildlife management and animal husbandry as related to rangeland management. The terms and outline of such research study shall be determined by a research design panel to be appointed by the President of the NATIONAL ACADEMY OF SCIENCES. Such study shall be completed and submitted by the Secretary to the Senate and House of Representatives on or before January 1, 1983.

[92 Stat. 1808-10 16 U.S.C. § 1333 (b)(1), (b)(3)]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-1122 (Committee on Interior and Insular Affairs). No. 95-1737 (Committee of Conference).
SENATE REPORT:	No. 95-1237 (Committee on Energy and Natural Resources).
CONGRESSIONAL RECORD:	
Vol. 124 (1978):	June 29, considered and passed House. Sept. 30, considered and passed Senate, amended. Oct. 10, House agreed to conference report. Oct. 11, Senate agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 14, No. 43:	Oct. 27, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Wild and Free-Roaming Horses and Burros

Public Law 97-341
97th Congress - S. 1872

CAPITOL REEF NATIONAL PARK, GRAZING PHASEOUT STUDY

96 Stat. 1639 October 15, 1982

SEC. 2. The Secretary of the Interior, acting through the Director of the National Park Service, in cooperation with the Director of the Bureau of Land Management, shall take such steps as may be necessary to, within ninety days after the enactment of this Act, enter into a contract with the NATIONAL ACADEMY OF SCIENCES for the purpose of conducting a study of grazing in Capitol Reef National Park and vicinity [Utah] to:

(1) determine the historic and current impact of grazing upon the natural ecosystem and cultural resources of the park;

(2) determine the impacts of grazing upon visitor use within the park;

(3) evaluate alternatives to grazing within Capitol Reef National Park including means to increase grazing carrying capacity on adjacent Bureau of Land Management lands;

(4) determine the economic impact upon grazing permit holders, and on the local economy, if such permits were terminated; and

(5) include such other information and findings as may be deemed necessary by the Secretary of the Interior.

Such study shall be conducted in accordance with the best scientific methodology (as set forth by the NATIONAL ACADEMY OF SCIENCES) and shall be transmitted by the NATIONAL ACADEMY OF SCIENCES to the Committee on Energy and Natural Resources of the United States Senate, to the Committee on Interior and Insular Affairs of the United States House of Representatives, and to the Director of the National Park Service no later than January 1, 1992. Progress reports regarding the study shall be transmitted to the above Committees on January 1, 1984, and January 1 of each year thereafter.

[96 Stat. 1639 16 U.S.C. § 273b note]

LEGISLATIVE HISTORY:

HOUSE REPORT: No. 97-823 (Committee on Interior and Insular Affairs).

SENATE REPORT: No. 97-448 (Committee on Energy and Natural Resources).

CONGRESSIONAL RECORD:
Vol. 128 (1982):
June 9, considered and passed Senate.
Sept. 20, considered and passed House, amended.
Sept. 30, Senate concurred in House amendments, with amendments; House concurred in Senate amendments.

REPORT RESULTING FROM THIS LEGISLATION:

Grazing Phaseout at Capitol Reef National Park

Public Law 98-409
98th Congress - H. R. 4214

STATE MINING AND MINERAL RESOURCES
RESEARCH INSTITUTE PROGRAM

98 Stat. 1536 August 29, 1984

COMMITTEE

SEC. 9. (a) The Secretary [of the Interior] shall appoint a Committee on Mining and Mineral Resources Research composed of--

(1) the Assistant Secretary of the Interior responsible for minerals and mining research, or his delegate;

(2) the Director, Bureau of Mines, or his delegate;

(3) the Director, United States Geological Survey, or his delegate;

(4) the Director of the National Science Foundation, or his delegate;

(5) the President, NATIONAL ACADEMY OF SCIENCES, or his delegate;

(6) the President, NATIONAL ACADEMY OF ENGINEERING, or his delegate; and

(7) not more than six other persons who are knowledgeable in the fields of mining and mineral resources research, including two university administrators involved in the conduct of programs authorized by section 301 of the Surface Mining Control and Reclamation Act of 1977, two representatives from the mining industry, a working miner, and a representative from the conservation community. In making these six appointments, the Secretary shall consult with interested groups.

(b) The Committee shall consult with, and make recommendations to, the Secretary on all matters relating to mining and mineral resources research and the determinations that are required to be made under this Act. The Secretary shall consult with, and consider recommendations of, such Committee in such matters.

(c) Committee members, other than officers or employees of Federal, State, or local governments, shall be, for each day (including traveltime) during which they are performing Committee business, paid at a rate fixed by the Secretary but not [in] excess of the daily equivalent of the maximum rate of pay for grade GS-18 of the General Schedule under section 5332 of title 5 of the United States

Code, and shall be fully reimbursed for travel, subsistence, and related expenses.

(d) The Committee shall be jointly chaired by the Assistant Secretary of the Interior responsible for minerals and mining and a person to be elected by the Committee from among the members referred to in paragraphs (5), (6), and (7) of subsection (a) of this section.

(e) The Committee shall develop a national plan for research in mining and mineral resources, considering ongoing efforts in the universities, the Federal Government, and the private sector, and shall formulate and recommend a program to implement the plan utilizing resources provided for under this Act. The Committee shall submit such plan to the Secretary, the President, and the Congress on or before March 1, 1986, and shall update the plan annually thereafter.

(f) Section 10 of the Federal Advisory Committee Act (5 U.S.C. App.) shall not apply to the Committee.

ELIGIBILITY CRITERIA

SEC. 10. (a) The Committee shall determine the eligibility of a college or university to participate as a mining and mineral resources research institute under this Act using criteria which include--

(1) the presence of a substantial program of graduate instruction and research in mining or mineral extraction or closely related fields which has a demonstrated history of achievement;

(2) evidence of institutional commitment for the purposes of this Act;

(3) evidence that such institution has or can obtain significant industrial cooperation in activities within the scope of this Act; and

(4) the presence of an engineering program in mining or minerals extraction that is accredited by the Accreditation Board for Engineering and Technology, or evidence of equivalent institutional capability as determined by the Committee.

(b) Notwithstanding the provisions of subsection (a), those colleges or universities which, on the date of enactment of this Act, have a mining or mineral resources research institute program which has been found to be eligible pursuant to title III of the Surface Mining Control and Reclamation Act of 1977 (91 Stat. 445) shall continue to be eligible pursuant to this Act for a period of four fiscal years beginning October 1, 1984.

[98 Stat. 1540-42 30 U.S.C. §§§ 1221, 1229, 1230]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 98-653 (Committee on Interior and Insular Affairs).
SENATE REPORT:	No. 98-437 (Committee on Energy and Natural Resources).
CONGRESSIONAL RECORD:	
Vol. 130 (1984):	Apr. 9, considered and passed House. Aug. 9, considered and passed Senate, amended. Aug. 10, House concurred in certain Senate amendment.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 20, No. 35 (1984):	Aug. 29, Presidential statement.

Public Law 98-425
98th Congress - H. R. 1437

CALIFORNIA WILDERNESS ACT OF 1984

98 Stat. 1619 September 28, 1984

TITLE III--ESTABLISHMENT OF NATIONAL FOREST SCENIC AREA

* * *

STUDIES

SEC. 305. The Secretary [of Agriculture] shall take such steps as may be necessary to, within one hundred and eighty days of the date of enactment of this title, enter into a contract with the NATIONAL ACADEMY OF SCIENCES for the purpose of conducting a scientific study of the ecology of the Scenic Area [Mono Basin National Forest Scenic Area, California]. The study shall provide for consultation with knowledgeable local, State, Federal, and private persons and organizations and shall provide findings and recommendations to the Congress. Such study shall be conducted in accordance with the best scientific methodology (as set forth by the NATIONAL ACADEMY OF SCIENCES) and shall be transmitted by the NATIONAL ACADEMY OF SCIENCES to the Committee on Energy and Natural Resources of the United States Senate, to the Committee on Interior and Insular Affairs of the United States House of Representatives, and to the Chief of the Forest Service not later than January 1, 1987. Progress reports regarding the study shall be transmitted to the above committees on January 1, 1985, and January 1 of each year thereafter.

[98 Stat. 1636-37 16 U.S.C. § 543d]

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 98-40 (Committee on Interior and Insular Affairs).
SENATE REPORT:	No. 98-582 (Committee on Energy and Natural Resources).
CONGRESSIONAL RECORD: Vol. 129 (1983):	Apr. 12, considered and passed House. Aug. 9, considered and passed Senate, amended. Sept. 12, House agreed to Senate amendment.

Public Law 98-473
98th Congress - H. J. Res. 648

DEPARTMENT OF THE INTERIOR AND RELATED AGENCIES APPROPRIATIONS ACT, 1985

98 Stat. 1837
October 12, 1984

[WILD HORSES AND BURROS]

The legislative history of the Act provides in relevant part:

TITLE I--DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

MANAGEMENT OF LANDS AND RESOURCES

* * *

The managers have agreed to a wild horse and burro program level of $17,081,000. An increase of $11,000,000 over the budget has been provided to increase the FY1985 removal rate to 11,000 excess animals and to remove the approximately 6,142 excess animals budgeted for but not removed in fiscal years 1983 and 1984. The managers recognize that this is a controversial program and that, in spite of spending over $2,000,000 for studies over the past several years, there is still significant disagreement concerning how many animals are excess, what historic levels were, and what is the current rate of reproduction. The managers have, therefore, included $1,000,000 for studies for the Bureau, through the NATIONAL ACADEMY OF SCIENCES, to continue to develop data to answer these and other pertinent questions.

HOUSE JOINT RESOLUTION 648, in CONGRESSIONAL RECORD--HOUSE, Vol. 130, No. 133, Part II, October 10, 1984, p. H 11920.

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 98-1030 (Committee on Appropriations). No. 98-1159 (Committee of Conference).
SENATE REPORT:	No. 98-634 accompanying S.J. Res. 356 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 130 (1984):	Sept. 25, considered and passed House. Sept. 27-29, Oct. 1-4, considered and passed Senate, amended. Oct. 10, House agreed to conference report; receded from its disagreement and concurred in a certain Senate amendment. Oct. 11, Senate agreed to conference report.

Marine Sciences

P. L. 92–522:	Marine Mammal Protection Act of 1972 (Includes amendment in P. L. 98–364)	167
P. L. 96–516:	National Science Foundation Authorization and Science and Technology Equal Opportunities Act (Ocean Margin Drilling Project)	170

Public Law 92-522
92nd Congress - H. R. 10420

MARINE MAMMAL PROTECTION ACT OF 1972

86 Stat. 1027 October 21, 1972

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as amended by

Public Law 98-364
98th Congress - H. R. 4997

AMENDMENT TO THE MARINE MAMMAL PROTECTION ACT OF 1972

98 Stat. 440 July 17, 1984

TITLE II--MARINE MAMMAL COMMISSION

ESTABLISHMENT OF COMMISSION

SEC. 201. (a) There is hereby established the Marine Mammal Commission (hereafter referred to in this title as the "Commission").

(b)(1) The Commission shall be composed of three members who shall be appointed by the President. The President shall make his selection from a list, submitted to him by the Chairman of the Council on Environmental Quality, the Secretary of the Smithsonian Institution, the Director of the National Science Foundation, and the Chairman of the NATIONAL ACADEMY OF SCIENCES, of individuals knowledgeable in the fields of marine ecology and resource management, and who are not in a position to profit from the taking of marine mammals. No member of the Commission may, during his period of service on the Commission, hold any other position as an officer or employee of the United States except as a retired officer or retired civilian employee of the United States.

[86 Stat. 1043 16 U.S.C. § 1401 (a), (b)(1)]

COMMITTEE OF SCIENTIFIC ADVISORS ON MARINE MAMMALS

SEC. 203. (a) The Commission shall establish, within ninety days after its establishment, a Committee of Scientific Advisors on Marine Mammals (hereafter referred to in this title as the "Committee"). Such Committee shall consist of nine scientists knowledgeable in marine ecology and marine mammal affairs appointed by the Chairman [of the Commission] after consultation with the Chairman of the Council on Environmental Quality, the Secretary of the Smithsonian Institution, the Director of the National Science Foundation, and the Chairman of the NATIONAL ACADEMY OF SCIENCES.

[86 Stat. 1044-45 16 U.S.C. § 1403 (a)]

AMENDMENT:

(1984) Section 103(a) of Public Law 98-364 amended section 201(b)(1) by striking the second sentence thereof and inserting in lieu thereof the following: "The President shall make his selection from a list of individuals knowledgeable in the fields of marine ecology and resource management, and who are not in a position to profit from the taking of marine mammals. Such list shall be submitted to him by the Chairman of the Council on Environmental Quality and unanimously agreed to by that Chairman, the Secretary of the Smithsonian Institution, the Director of the National Science Foundation and the Chairman of the NATIONAL ACADEMY OF SCIENCES."

[98 Stat. 441-2 16 U.S.C. § 1401 (b)(1)]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 92-707 (Committee on Merchant Marine and Fisheries). No. 92-1488 (Committee of Conference).
SENATE REPORT:	No. 92-863 accompanying S. 2871 (Committee on Commerce).

CONGRESSIONAL RECORD:

Vol. 117 (1971):	Dec. 6, considered in House.
Vol. 118 (1972):	Mar. 9, considered and passed House. July 25, 26, considered and passed Senate, amended, in lieu of S. 2871. Oct. 10, House agreed to conference report. Oct. 11, Senate agreed to conference report.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:

Vol. 8, No. 44 (1972):	Oct. 28, Presidential statement.

Public Law 96-516
96th Congress - S. 568

NATIONAL SCIENCE FOUNDATION AUTHORIZATION AND SCIENCE AND TECHNOLOGY EQUAL OPPORTUNITIES ACT

94 Stat. 3007 December 12, 1980

OCEAN MARGIN DRILLING PROJECT REPORT

* * *

SEC. 14. (b) The NATIONAL ACADEMY OF SCIENCES shall study marine earth sciences research and report to the Congress.

[94 Stat. 3008 Not codified]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 96-999 accompanying H.R. 7115 (Committee on Science and Technology). No. 96-1474 (Committee of Conference).
SENATE REPORTS:	No. 96-713 (Committee on Labor and Human Resources). No. 96-1028 (Committee of Conference).
CONGRESSIONAL RECORD: Vol. 126 (1980):	June 16, H. R. 7115 considered in House. June 23, S. 568 considered and passed Senate. Sept. 4, H.R. 7115 considered and passed House; passage vacated and S. 568, amended, passed in lieu. Nov. 21, Senate agreed to conference report. Dec. 2, House agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Options for Scientific Ocean Drilling

Physics

P. L. 98–371:	Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1985 (Review of Research on Underwater Neutrinos)	175

Public Law 98-371
98th Congress - H. R. 5713

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT—INDEPENDENT AGENCIES APPROPRIATION ACT, 1985

98 Stat. 1213 July 18, 1984

[UNDERWATER NEUTRINOS, REVIEW OF RESEARCH]

The legislative history of the Act provides in relevant part:

TITLE II--INDEPENDENT AGENCIES

* * *

NATIONAL SCIENCE FOUNDATION

* * *

COMMITTEE RECOMMENDATION

* * *

The Committee notes with interest the important research taking place in physics on underwater neutrinos. This work is underway in both the United States and the U.S.S.R. The Committee directs NSF to request the NATIONAL ACADEMY OF SCIENCES to review this area of research and determine its priority.

SENATE REPORT No. 98-506, 98th Congress, 2nd Session, p. 77 (1984).

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 98-803 (Committee on Appropriations). No. 98-867 (Committee of Conference).

SENATE REPORT: No. 98-506 (Committee on Appropriations).

CONGRESSIONAL RECORD:

Vol. 130 (1984):
- May 30, considered and passed House.
- June 21, considered and passed Senate, amended.
- June 27, House agreed to conference report, receded and concurred in certain Senate amendments and in others with amendments; Senate agreed to conference report and concurred in House amendments.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:

Vol. 20, No. 29 (1984): July 18, Presidential statement.

Space Sciences

P. L. 97–12: Supplemental Appropriations and Rescission Act, 1981 [Review of International Solar Polar Mission] 179

P. L. 98–52: National Aeronautics and Space Administration Authorization Act, 1984 [Study of Sun–Earth Interactions] 181

Public Law 97-12
97th Congress - H. R. 3512

SUPPLEMENTAL APPROPRIATIONS AND RESCISSION ACT, 1981

95 Stat. 14 June 5, 1981

The legislative history of the Act provides in relevant part:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

(RESCISSION)

Amendment No. 120:

* * *

To assist the Administration and Congress in making a decision, the conferees instruct NASA to initiate a review of ISPM [International Solar Polar Mission], with the NATIONAL ACADEMY OF SCIENCES, through the procedures established in House Report 96-1476. The conferees expect this review to consider the scientific merits and costs of all of the two spacecraft options. Because of the time criticality of the decision, the conferees expect to be briefed by the review panel on its recommendations by September 11, 1981.

HOUSE REPORT No. 124, 97th Congress, 1st Session, pp. 54-55 (1981).

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 97-124 (Committee of Conference).
SENATE REPORT:	No. 97-67 (Committee on Appropriations).

CONGRESSIONAL RECORD:

Vol. 127 (1981):	May 12, 13, considered and passed House.
Vol. 128 (1982):	May 19-21, considered and passed Senate, amended. June 4, House agreed to conference report, receded and concurred in certain Senate amendments, in others with amendments. Senate agreed to conference report; resolved amendments in disagreement.

REPORT RESULTING FROM THIS LEGISLATION:

The International Solar Polar Mission: A Review and Assessment of Options

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Public Law 98-52
98th Congress - H. R. 2065

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1984

97 Stat. 281
July 15, 1983

[STUDY OF SUN-EARTH INTERACTIONS]

The legislative history of the Act provides in relevant parts:

AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR FISCAL YEAR 1984

TITLE I—RESEARCH AND DEVELOPMENT

* * *

SPACE APPLICATIONS

* * *

Environmental Observations. NASA requested $163,000,000 for this program in fiscal year 1984 and the Committee recommends an increase to $166,000,000. The addition of $3,000,000 for space physics includes...$1 million to support a study to be conducted by the NATIONAL RESEARCH COUNCIL on Sun-Earth interactions. The study is explicitly requested and described in the section of Committee Views on Space Applications.

* * *

COMMITTEE VIEWS

* * *

SPACE APPLICATIONS

* * *

Study of Sun-Earth Interaction. Many in the scientific community believe that a better scientific understanding of Sun-Earth interaction would contribute significantly to the solution of many global scientific problems. The inadequate funding for the Origin of Plasmas in the Earth's Neighborhood (OPEN) mission as well as the delay of the Upper Atmosphere Research Satellite (UARS) and the cancellation of the U.S. part of the International Solar Polar Mission (ISPM) all seem to indicate a lack of appreciation on the part of the Agency of the importance of Sun-Earth interactions. The Sun and its dynamics affect weather, climate, oceans and communications on Earth. Part of the reason for the lack of appreciation appears to be that the scientific community is split into factions--solar physicists, space-plasma physicists, meteorologists, stratospheric researchers, climatologists, and others. Yet the various phenomena are related and are often of critical and immediate economic importance on Earth. For this reason, the Committee has recommended an increase of $1 million for a study, to be conducted through the NATIONAL RESEARCH COUNCIL of the NATIONAL ACADEMIES OF SCIENCE and ENGINEERING [NAS/NAE], of the scientific connections and importance of Sun-Earth interactions.

The study should lay out these interactions and their scientific and practical importance, and building on this base, develop a plan for Federal research (both basic and applied) in this area. In this latter respect the report of the Astronomy Survey Committee might be a useful model.

The Committee would expect that the center-of-gravity of this study would lie with the Space Science and Space Applications Boards of the NAS and NAE, but emphasizes that other ACADEMY groups would have to be brought into the study--for example the Climate Research Board and the Committee on Atmospheric Sciences. In this respect, the study would be somewhat analogous to that of the Astronomy Survey Committee which went beyond the Space Science Board as well as beyond NASA in its scope. Indeed the Agencies for whom the study would be of interest would include NASA, NOAA, DOD (Air Force and Navy in particular), NSF, and the USGS. The Committee feels that this study is timely, and requests that the Agency promptly initiate the study with a view toward completing it, or at least having a substantial interim report, in time for the FY 1985 budget consideration. The results of the study should be reported to both Houses of the Congress.

HOUSE REPORT No. 98-65, 98th Congress, 1st Session, pp. 10 and 20 (1983).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT

* * *

RESEARCH AND DEVELOPMENT

* * *

Committee Comment

The Committee attaches a great deal of importance to the overall space applications program. To insure that the Nation is investing sufficiently and wisely in this area, the Committee believes a long-term strategy and plan for the applications program is warranted, comparable to the excellent effort conducted by the Solar System Exploration Committee for the planetary exploration program. The Committee requests NASA to undertake such an effort covering all activities within the applications program. The Space Applications Board of the NATIONAL RESEARCH COUNCIL might be able to assist in such an effort.

SENATE REPORT No. 98-108, 98th Congress, 1st Session, p. 25 (1983).

LEGISLATIVE HISTORY:

HOUSE REPORT:	No. 98-65 (Committee on Science and Technology).
SENATE REPORT:	No. 98-108 accompanying S. 1096 (Committee on Commerce, Science, and Transportation).
CONGRESSIONAL RECORD: Vol. 129 (1983):	Apr. 26, considered and passed House. June 15, S. 1096 considered and passed Senate. June 28, H.R. 2065 considered and passed Senate, amended. June 29, House concurred in Senate amendments.

Transportation—Air

P. L. 97–369:	Department of Transportation and Related Agencies Appropriations Act, 1983 (Wind Shear Study)	187
P. L. 98–466:	An Act to Determine the Adequacy of Certain Industry Practices and Federal Aviation Administration Rules and Regulations (Air Cabin Air Quality Study)	189

Public Law 97-369
97th Congress - H. R. 7019

DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS ACT, 1983

96 Stat. 1765
December 18, 1982

TITLE I--DEPARTMENT OF TRANSPORTATION

* * *

FEDERAL AVIATION ADMINISTRATION

* * *

OPERATIONS

[WIND SHEAR STUDY]

...Provided further, That not to exceed $500,000 of the total amount available for operation shall be obligated for a contract with the NATIONAL ACADEMY OF SCIENCES and the Federal Aviation Administration Administrator shall enter into an agreement with the NATIONAL ACADEMY OF SCIENCES to study the state of knowledge, alternative approaches and the consequences of wind shear alert and severe weather condition standards relating to take-off and landing clearances for commercial and general aviation aircraft: Provided further, That the ACADEMY shall complete the study within six months after funding arrangements have been made: Provided further, That the Federal Aviation Administration Administrator shall report to Congress within thirty days regarding the status of the contractual arrangements and the conditions necessary to implement the agreement with the NATIONAL ACADEMY OF SCIENCES: Provided further, That the Department of Transportation shall furnish to the NATIONAL ACADEMY OF SCIENCES any information which the ACADEMY determines to be necessary for the purpose of conducting the study...[.]

[96 Stat. 1768
Not codified]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 97-783 (Committee on Appropriations). No. 97-960 (Committee of Conference).
SENATE REPORTS:	No. 97-546 accompanying S. 2914 (Committee on Appropriations). No. 97-567 (Committee on Appropriations).
CONGRESSIONAL RECORD: Vol. 128 (1982):	Sept. 16, 21, considered and passed House. Dec. 2, considered and passed Senate, amended. Dec. 16, House agreed to conference report; concurred in certain Senate amendments, in others with amendments; Senate agreed to conference report; concurred in House amendments.

REPORT RESULTING FROM THIS LEGISLATION:

Low-Altitude Wind Shear and Its Hazard to Aviation

Public Law 98-466
98th Congress - S. 197

AN ACT TO DETERMINE THE ADEQUACY OF CERTAIN INDUSTRY PRACTICES AND FEDERAL AVIATION ADMINISTRATION RULES AND REGULATIONS

98 Stat. 1825

October 11, 1984

[STUDY OF AIRLINE CABIN AIR QUALITY]

SEC. 1. (a) The Secretary of Transportation shall, in the interest of health and safety, and in the interest of promoting and maintaining a superior United States aviation industry, commission an independent study by the NATIONAL ACADEMY OF SCIENCES. The study shall determine whether civil commercial aviation industry practices and standards and Federal Aviation Administration rules, regulations, and minimum standards are nondiscriminatory and at least in conformance and parity with nonaviation standards, practices, and regulations for the appropriate maintenance of public and occupational health and safety (including de facto circumstances) in relation to airline cabin air quality for all passengers and crew aboard civil commercial aircraft.

(b) In conducting the study, special and objective considerations shall be given to the uniqueness of the environment on board civil commercial aircraft. The study shall focus on all health and safety aspects of airline cabin air quality, including but not limited to--

(1) the quantity of fresh air per occupant and overall quality of air onboard;

(2) the quantity and quality of humidification;

(3) onboard environmental conditions and contamination limits, including exposure to radiation;

(4) emergency breathing equipment, including toxic fume-protective breathing equipment;

(5) measures, procedures, and capabilities for detecting and extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits;

(6) safe pressurization of the aircraft, considering the broad range of cardiopulmonary health of the traveling public, and dissemination of information to the medical profession and the general public of current pressurization limits and practices to assure valid medical advice concerning the health effects of air travel;

(7) the feasibility of collection and dissemination by the aviation industry, the Federal Aviation Administration, or any other private or governmental organization of a data base of medical statistics and environmental factors relating to air travel, including but not limited to, maintenance and operation records and procedures of aircraft, in an effort to assess the adequacy of aircraft systems, design, regulations, standards and practices relating to airline cabin air quality from the standpoint of health and safety, and for the purpose of issuing Federal Aviation Administration administrative advisory circulars and airworthiness directive regulations to correct any deficiencies disclosed;

(8) the adequacy of current preflight and inflight health and safety instructions for air travelers that relate to airline cabin air quality, including but not limited to, life safety procedures during inflight fire, smoke, and toxic fume emergencies; and

(9) a comparison of foreign industry practices, regulations, and standards.

(c) In conducting the study, special care shall be taken to assure that all existing studies, recommendations, data, and state of the art technology relevant to the health and safety aspects of airline cabin air quality are considered.

(d) In conducting the study, the NATIONAL ACADEMY OF SCIENCES shall consult with and solicit the views of academic experts, representatives of airline labor, the aviation industry and independent experts and organizations.

(e) The study shall include such recommendations for legislative, regulatory, and industry changes as the NATIONAL ACADEMY OF SCIENCES determines to be advisable for promotion of health and safety in relation to airline cabin air quality.

SEC. 2. The Secretary of Transportation shall submit a copy of the study, as it was prepared by the NATIONAL ACADEMY OF SCIENCES, to the Congress within eighteen months after the date of enactment of this Act. At such time the Secretary shall also set forth such comments on the matters covered by the study and such recommendations for legislative, regulatory, and industry changes as the Secretary determines to be necessary.

SEC. 3. There is authorized to be appropriated not to exceed $500,000 for the fiscal year commencing October 1, 1984, to carry out the study authorized by this Act. Such funds shall remain available for obligation until expended.

[98 Stat. 1825-26 49 U.S.C. App. § 1303 note]

LEGISLATIVE HISTORY:

SENATE REPORT:	No. 98-468 (Committee on Commerce, Science, and Transportation).
CONGRESSIONAL RECORD: Vol. 130 (1984):	June 15, considered and passed Senate. Oct. 1, considered and passed House.

Transportation—Land

P. L. 95–599:	Highway Safety Act of 1978 (Title II of the Surface Transportation Assistance Act of 1978) (Safety Belt Study)	195
P. L. 97–261:	Bus Regulatory Reform Act of 1982 (Study of Citizen Band Radios on Buses)	197
P. L. 97–424:	Surface Transportation Assistance Act of 1982 (Title I—Highway Improvement Act of 1982) (Resurfacing Standards; Manpower Study; Monitoring Effects of Double Bottom Trucks; 55 m.p.h. Benefits Study)	199

(See also P. L. 98–63 and P. L. 98–78 under HEALTH RESEARCH)

Public Law 95-599
95th Congress - H. R. 11733

HIGHWAY SAFETY ACT OF 1978
(TITLE II OF THE SURFACE TRANSPORTATION ASSISTANCE ACT OF 1978)

92 Stat. 2727
November 6, 1978

SAFETY BELT STUDY

SEC. 214. The Secretary of Transportation shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct a comprehensive study and investigation of methods of encouraging the use of safety belts by drivers of, and passengers in, motor vehicles, including, but not limited to, the use of various types of financial incentives and financial disincentives to encourage such use. In entering into any arrangement with the NATIONAL ACADEMY OF SCIENCES for conducting such study and investigation, the Secretary shall request the NATIONAL ACADEMY OF SCIENCES to report to the Secretary and the Congress not later than one year after the date of enactment of this Act on the results of such study and investigation, together with its recommendations. The Secretary shall furnish to such ACADEMY at its request any information which the ACADEMY deems necessary for the purpose of conducting the investigation and study authorized by this section.

[92 Stat. 2734 23 U.S.C. § 402 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 95-1485 (Committee on Public Works and Transportation). No. 95-1797 (Committee of Conference).
SENATE REPORT:	No. 95-833 (Committee on Environment and Public Works).

CONGRESSIONAL RECORD:

Vol. 124 (1978):
- Aug. 18, 21, 28, S. 3073 considered in Senate.
- Sept. 15, 21, 22, 27, 28, considered and passed House.
- Oct. 3, considered and passed Senate, amended, in lieu of S. 3073.
- Oct. 15, Senate and House agreed to conference report.

REPORT RESULTING FROM THIS LEGISLATION:

Study of Methods for Increasing Safety Belt Use

Public Law 97-261
97th Congress - H. R. 3663

BUS REGULATORY REFORM ACT OF 1982

96 Stat. 1102

September 20, 1982

STUDY OF CITIZEN BAND RADIOS ON BUSES

SEC. 25. (a) The Secretary of Transportation shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct a study of the use of citizen band radios on motor vehicles providing transportation of passengers subject to the jurisdiction of the Interstate Commerce Commission under subchapter II of chapter 105 of title 49, United States Code, by the operators of such vehicles. Such study shall determine, at a minimum, the following:

(1) the effect on safety if such operators are authorized to use such radios; and

(2) the effect on safety, health, and convenience of the passengers of such vehicles if such operators are authorized to use such radios.

(b) The Secretary of Tranportation shall request the NATIONAL ACADEMY OF SCIENCES to submit to the Secretary and the Congress, within one year after entering into arrangements with the NATIONAL ACADEMY OF SCIENCES for conducting the study under subsection (a) of this section, a report on the results of such study along with its recommendations concerning whether operators of motor vehicles providing transportation of passengers should be allowed to use citizen band radios. The Secretary shall furnish to such ACADEMY, at its request, any information which such ACADEMY deems necessary for the purpose of conducting such study.

(c) Not later than 60 days after the NATIONAL ACADEMY OF SCIENCES submits its report to the Secretary of Transportation under subsection (b) of this section, the Secretary of Transportation shall initiate a rulemaking proceeding to determine whether operators of motor vehicles providing transportation of passengers subject to the jurisdiction of the Interstate Commerce Commission under subchapter II of chapter 105 of title 49, United States Code, should be allowed to use citizen band radios in such vehicles. In making such determination, the Secretary of Transportation shall give substantial weight to the recommendations and conclusions of the

NATIONAL ACADEMY OF SCIENCES. Such rulemaking proceeding shall be completed not later than 120 days after such proceeding is commenced. If the Secretary issues a rule or regulation which recommends that operators of such vehicles be allowed to install temporarily and operate citizen band radios in such vehicles, the Secretary of Transportation shall issue regulations establishing guidelines for the use of such radios in such vehicles in order to ensure that the public safety is adequately protected.

[96 Stat. 1124-25 49 U.S.C. § 11111 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 97-334 (Committee on Public Works and Transportation). No. 97-780 (Committee of Conference).
SENATE REPORT:	No. 97-411 (Committee on Commerce, Science, and Transportation).
CONGRESSIONAL RECORD:	
Vol. 127 (1981):	Nov. 19, considered and passed House.
Vol. 128 (1982):	June 30, considered and passed Senate, amended. Aug. 19, House agreed to conference report. Aug. 20, Senate agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:	
Vol. 18, No. 38 (1982):	Sept. 20, Presidential statement.

REPORT RESULTING FROM THIS LEGISLATION:

Should Intercity Bus Drivers Be Allowed to Use CB Radios?

Public Law 97-424
97th Congress - H. R. 6211

SURFACE TRANSPORTATION ASSISTANCE ACT OF 1982

96 Stat. 2097 January 6, 1983

TITLE I--HIGHWAY IMPROVEMENT ACT OF 1982

* * *

RESURFACING STANDARDS

* * *

SEC. 110. (b) The Secretary of Transportation shall enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES (1) to conduct a study of the safety cost-effectiveness of geometric design criteria of standards currently in effect for construction and reconstruction of highways, other than highways access to which is fully controlled, to determine the most appropriate minimum standards to apply to resurfacing, restoration, and rehabilitation projects on such highways, which study shall include a study of the cost-effectiveness of the hot dip galvanizing process for the installation, repair, or replacement of exposed structural and miscellaneous steel, and (2) to propose standards to preserve and extend the service life of such highways and enhance highway safety. The NATIONAL ACADEMY OF SCIENCES shall conduct such study in cooperation with the National Transportation Safety Board, the Congressional Budget Office, and the American Association of State Highway and Transportation Officials. Upon completion of such study, the NATIONAL ACADEMY OF SCIENCES shall submit such study and its proposed standards to the Secretary of Transportation for review. Within ninety days after submission of such standards to the Secretary of Transportation, the Secretary shall submit such study and the proposed standards of the NATIONAL ACADEMY OF SCIENCES, together with the recommendations of the Secretary, to Congress for approval.

[96 Stat. 2105 23 U.S.C. § 109 note]

MANPOWER STUDY

SEC. 135. The Secretary of Transportation shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES' Transportation Research Board to conduct a comprehensive study and investigation of future transportation professional manpower needs, including but not limited to prevailing methods of recruitment, training, and financial and other incentives and disincentives which encourage or discourage retention in service of such professional manpower by Federal, State, and local governments. In entering into any arrangement with the NATIONAL ACADEMY OF SCIENCES for conducting such study and investigation, the Secretary shall request the NATIONAL ACADEMY OF SCIENCES to report to the Secretary and the Congress not later than two years after the enactment of this Act on the results of such study and investigation, together with its recommendations. The Secretary shall furnish to the ACADEMY at its request any information which the ACADEMY deems necessary for the purpose of conducting the study and investigation authorized by this section.

[96 Stat. 2125 23 U.S.C. § 101 note]

MONITORING OF EFFECT OF DOUBLE BOTTOM TRUCKS

SEC. 144. (a) The Secretary of Transportation shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to monitor the effects on the National System of Interstate and Defense Highways of the use of trucks with two trailing units, in light of the amendments made by this Act providing that no State shall prohibit the use of such vehicle combinations. Such monitoring shall include, but need not be limited to, determining the effects of the use of such vehicle combinations on highways and highway safety in urban and rural areas and in different regions of the country, taking into account differences in age and design features of highways on the Interstate System.

(b) The Secretary of Transportation shall request the NATIONAL ACADEMY OF SCIENCES to submit a report to the Secretary and the Congress of such monitoring, not later than two years after appropriate arrangements are entered into under subsection (a). The Secretary shall furnish to the ACADEMY, at its request, any information which the ACADEMY deems necessary for the purpose of conducting such monitoring.

[96 Stat. 2129 49 U.S.C. App. § 2315 note]

TITLE II--HIGHWAY SAFETY ACT OF 1982

* * *

55 M.P.H. BENEFITS STUDY

SEC. 204. The Secretary of Transportation shall undertake to enter into appropriate arrangements with the NATIONAL ACADEMY OF SCIENCES to conduct a comprehensive study and investigation of (1) the benefits, both human and economic, of lowered speeds due to the enactment of the 55 mile per hour National Maximum Speed Limit, with particular attention to savings to the taxpayers, and (2) whether the laws of each State constitute a substantial deterrent to violations of the maximum speed limit on public highways within such State. In entering into any arrangement with the NATIONAL ACADEMY OF SCIENCES for conducting such study and investigation, the Secretary shall request the NATIONAL ACADEMY OF SCIENCES to report to the Secretary and the Congress not later than twelve months after the date of enactment of this Act on the results of such study and investigation, together with its recommendations. The Secretary shall furnish to such ACADEMY at its request any information which the ACADEMY deems necessary for the purpose of conducting the investigation and study authorized by this section.

[96 Stat. 2138-39 23 U.S.C. § 154 note]

LEGISLATIVE HISTORY:

HOUSE REPORTS:	No. 97-555 (Committee on Public Works and Transportation). No. 97-987 (Committee of Conference).
CONGRESSIONAL RECORD: Vol. 128 (1982):	Dec. 6, considered and passed House. Dec. 10, 13-16, 19-21, considered and passed Senate, amended. Dec. 21, House agreed to conference report. Dec. 21, 23, Senate considered and agreed to conference report.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:
Vol. 19, No. 1 (1983): Jan. 6, Presidential statement.

REPORTS RESULTING FROM THIS LEGISLATION:

Cost-Effectiveness of Hot Dip Galvanizing for Exposed Steel

Transportation Professionals: Needs and Opportunities

55: A Decade of Experience

Tables

Chronological List of Laws and Titles of Resultant Reports (Where Called For) 205

Chronological List of Executive Orders 211

Chronological List of Laws* And Titles of Resultant Reports

(Where Called For)

PUBLIC LAW	POPULAR NAME	TITLE OF REPORT(S)	PAGE
37th Congress, Session 3, Chapter 111	An Act to Incorporate the National Academy of Sciences	—	3
41st Congress, Session 2, Chapter 264	An Act to Amend the Act to Incorporate the National Academy of Sciences	—	3
48th Congress, Session 1, Chapter 107	An Act to Authorize the National Academy of Sciences to Receive and Hold Trust Funds for the Promotion of Science, and for Other Purposes	—	3
63rd Congress, Session 2, Chapter 101, P. L. 109	An Act to Amend the Act Authorizing the National Academy of Sciences to Receive and Hold Trust Funds for the Promotion of Science, and for Other Purposes	—	3
86-209	An Act to Establish a National Medal of Science	—	9
86-373	Atomic Energy Act of 1954, Amendments (Federal Radiation Council)	—	67
86-618	Color Additive Amendments of 1960	—	21
90-407	National Science Foundation Act of 1950, Amendments (National Science Board)	—	12
91-441	Armed Forces Appropriation Authorization, 1971 (Herbicides and Defoliation Study)	*The Effects of Herbicides in South Vietnam*	87
91-604	Clean Air Amendments of 1970 Motor Vehicle Emission Standards	*Motor Vehicle Emissions*	37
92-500	Federal Water Pollution Control Act Amendments of 1972 (Effluent Limitations)	*Report to the National Commission on Water Quality*	41
92-516	Federal Environmental Pesticide Control Act of 1972	—	89
92-522	Marine Mammal Protection Act of 1972 (Includes amending P. L. 98-364)	—	167
93-82	Veterans Health Care Expansion Act of 1973	*Health Care for American Veterans*	117
93-112	Rehabilitation Act of 1973	*Ability Testing of Handicapped People: Dilemma for Government, Science, and the Public*	103

---

* Where the title of the law does not indicate the subject matter of the institution's task, explanatory words are added in parentheses.

PUBLIC LAW	POPULAR NAME	TITLE OF REPORT(S)	PAGE
93-135	Agriculture-Environmental and Consumer Protection Appropriation Act (Study of Environmental Protection Agency programs)	Vol. Title	93
		1 *Perspectives on Technical Information for Environmental Protection*	
		2 *Decision Making in the Environmental Protection Agency*	
		3 *Research and Development in the Environmental Protection Agency*	
		3a *Sources of Residuals and Techniques for Their Control: Research and Development Needs*	
		3b *Fates of Pollutants: Research and Development Needs*	
		3c *Effects of a Polluted Environment: Research and Development Needs*	
		3d *Environmental Impacts of Resource Management: Research and Development Needs*	
		4 *Environmental Monitoring*	
		5 *Manpower for Environmental Pollution Control*	
		6 *Implications of Environmental Regulations for Energy Production and Consumption*	
		7 *Pesticide Decision Making*	
		8 *Noise Abatement: Policy Alternatives for Transportation*	
		9 *Multimedium Management of Municipal Sludge*	

PUBLIC LAW	POPULAR NAME	TITLE OF REPORT(S)	PAGE
		10 Disposal in the Marine Environment: An Oceanographic Assessment	
93-154	Emergency Medical Services Systems Act of 1973 (Includes amending P. L. 94-573)	—	105
93-222	Health Maintenance Organization Act of 1973	*Assessing Quality in Health Care: An Evaluation*	107
93-233	Social Security Amendments of 1973 (Physicians' Services in Teaching Hospitals)	*Medicare-Medicaid Reimbursement Policies*	119
93-251	Water Resources Development Act of 1974	*The Potomac Estuary Experimental Water Treatment Plant*	145
93-348	National Research Service Award Act of 1974 (Includes amending P. L. 94-278 and P. L. 95-622)	*Personnel Needs and Training for Biomedical and Behavioral Research*	121
93-383	Housing and Community Development Act of 1974 (National Institute of Building Sciences)	—	61
93-523	Safe Drinking Water Act (Includes amending P. L. 95-190)	*Drinking Water and Health*	44
94-278	Health Research and Health Services Amendments of 1976 (Text with P. L. 93-348, which it amends)	*Personnel Needs and Training for Biomedical and Behavioral Research*	121
94-317	Disease Control Amendments of 1976 (Lead-Based Paint)	*Recommendations for the Prevention of Lead Poisoning in Children*	69
94-562	Arthritis, Diabetes, and Digestive Disease Amendments of 1976	—	131
94-573	Emergency Medical Services Amendments of 1976 (Text with P. L. 93-154, which it amends)	—	105
95-83	Health Planning and Health Services Research and Statistics Extension Act of 1977 (International Health Activities Study)	*Strengthening U.S. Programs to Improve Health in Developing Countries*	110
95-87	Surface Mining Control and Reclamation Act of 1977 (Includes amending P. L. 95-617)	*Surface Coal Mining in Alaska* *Surface Mining of Non-Coal Minerals* *Criteria for Establishing University Coal Research Laboratories*	148

PUBLIC LAW	POPULAR NAME	TITLE OF REPORT(S)	PAGE
95-95	Clean Air Act Amendments of 1977	*Protection Against Depletion of Stratospheric Ozone by Chlorofluorocarbons*	49
95-113	National Agricultural Research, Extension, and Teaching Policy Act of 1977 (Solar Energy Research Information System)	—	23
95-190	Safe Drinking Water Amendments of 1977 (Text with P. L. 93-523, which it amends)	*Drinking Water and Health*	44
95-203	Saccharin Study and Labeling Act	*Saccharin: Technical Assessment of Risks and Benefits (Part 1)* *Food Safety Policy: Scientific and Societal Considerations (Part 2)*	25
95-448	Agriculture, Rural Development, and Related Agencies Appropriations, Fiscal Year 1979 (Antibiotics in Animal Feed; Cotton Dust Standards)	*The Effects on Human Health of Subtherapeutic Use of Antimicrobials in Animal Feeds* *Byssinosis: Clinical and Research Issues*	28
95-477	Environmental Research, Development, and Demonstration Authorization Act of 1979	—	97
95-514	Public Rangelands Improvement Act of 1978	*Wild and Free-Roaming Horses and Burros*	153
95-599	Highway Safety Act of 1978	*Study of Methods for Increasing Safety Belt Use*	195
95-617	Public Utility Regulatory Policies Act of 1978 (Text with P. L. 95-87, which it amends)	*Surface Coal Mining in Alaska* *Surface Mining of Non-Coal Minerals* *Criteria for Establishing University Coal Research Laboratories*	148
95-622	Biomedical Research and Research Training Amendments of 1978 (Low-Level Ionizing Radiation)	*Federal Research on the Biological and Health Effects of Ionizing Radiation*	71
95-622	Biomedical Research and Research Training Amendments of 1978 (This excerpt is with P. L. 93-348, which it amends)	*Personnel Needs and Training for Biomedical and Behavioral Research*	121

PUBLIC LAW	POPULAR NAME	TITLE OF REPORT(S)	PAGE
95-623	Health Services Research, Health Statistics, and Health Care Technology Act of 1978	*Costs of Environment-Related Health Effects: A Plan for Continuing Study*	74
95-625	National Parks and Recreation Act of 1978 (Albert Einstein Memorial)	—	14
96-76	Nurse Training Amendments of 1979	*Nursing and Nursing Education: Public Policies and Private Actions*	124
96-108	Agriculture, Rural Development and Related Agencies Appropriation, 1980 (Antibiotics in Animal Feed)	*The Effects on Human Health of Subtherapeutic Use of Antimicrobials in Animal Feeds*	32
96-205	United States Insular Areas Appropriation Authorization (Radiation Exposure Compensation Advisory Committee for the Marshall Islands)	—	77
96-229	Environmental Research, Development, and Demonstration Authorization Act of 1980 (Nonnuclear Hazardous Waste Disposal Study)	—	99
96-294	Energy Security Act (Carbon Dioxide Study)	*Changing Climate*	55
96-516	National Science Foundation Authorization and Science and Technology Equal Opportunities Act	*Options for Scientific Ocean Drilling*	170
96-526	Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1981 (Postperformance Evaluation of Scientific Research)	*The Quality of Research in Science*	16
96-528	Agriculture, Rural Development, and Related Agencies Appropriations, Fiscal Year 1980	*Risk Assessment in the Federal Government: Managing the Process*	80
96-538	Health Programs Extension Act of 1980 (Neurological Research)	—	133
97-12	Supplemental Appropriations and Rescission Act, 1981	*The International Solar Polar Mission: A Review and Assessment of Options*	179
97-35	Omnibus Budget Reconciliation Act of 1981—Consumer Product Safety Amendments of 1981 (Chronic Hazard Advisory Panel)	—	82
97-35	Omnibus Budget Reconciliation Act of 1981—National Health Service Corps (Physician Study)	—	127

PUBLIC LAW	POPULAR NAME	TITLE OF REPORT(S)	PAGE
97-261	Bus Regulatory Reform Act of 1982	*Should Intercity Bus Drivers Be Allowed to Use CB Radios?*	197
97-341	Capitol Reef National Park, Grazing Phaseout Study	*Grazing Phaseout at Capitol Reef National Park*	155
97-369	Department of Transportation and Related Agencies Appropriations Act, 1983	*Low-Altitude Wind Shear and Its Hazard to Aviation*	187
97-424	Surface Transportation Assistance Act of 1982 (Resurfacing Standards; Manpower Study; Monitoring Effects of Double Bottom Trucks; 55 m.p.h. Benefits Study)	*Cost-Effectiveness of Hot Dip Galvanizing for Exposed Steel* *Transportation Professionals: Needs and Opportunities* *55: A Decade of Experience*	199
98-52	National Aeronautics and Space Administration Authorization Act, 1984 (Study of Sun-Earth Interactions)	(In progress)	181
98-63	Supplemental Appropriations Act, 1983 (Trauma Research)	*Injury in America: A Continuing Public Health Problem*	135
98-78	Department of Transportation and Related Agencies Appropriations Act, 1983 (Trauma Research)	*Injury in America: A Continuing Public Health Problem*	137
98-364	Amendment to the Marine Mammal Protection Act of 1972 (Text with P. L. 92-522, which it amends)	—	167
98-371	Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1985 (Review of Research on Underwater Neutrinos)	(In progress)	175
98-409	State Mining and Mineral Resources Research Institute Program	(In progress)	157
98-425	California Wilderness Act of 1984	(In progress)	160
98-460	Social Security Disability Benefits Reform Act of 1984 (Evaluation of Pain)	(In progress)	139
98-466	An Act to Determine the Adequacy of Certain Industry Practices and Federal Aviation Administration Rules and Regulations (Airline Cabin Air Quality Study)	(In progress)	189
98-473	Department of the Interior and Related Agencies Appropriations Act, 1985 (Wild Horse and Burro Levels)	(In progress)	162
98-551	Health Promotion and Disease Prevention Amendments of 1984 (Council on Health Care Technology)	(In progress)	112

Chronological List of Executive Orders

NO.	HEADING	PAGE
2859	Perpetuation of the National Research Council	7
10668	Amendment of Executive Order No. 2859, Expanding the Charge of the National Research Council	7
11287	Committee Membership and Recommendations for the National Medal of Science	10

Index

[illegible]

Index

A

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Ability testing, handicapped people	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Advisory Committee on Mining and Mineral Research	P. L. 95-87	30 U.S.C. 1229	148-52
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Agricultural Research Service, cotton dust standards	P. L. 95-448	n.c.[1]	28-31
Agriculture			
Antibiotics in animal feed	P. L. 95-448	n.c.	28-31
	P. L. 96-108	n.c.	32-33
Cotton dust standards	P. L. 95-448	n.c.	28-31
Solar energy	P. L. 95-113	7 U.S.C. 3251	23-24
Agriculture, Department of			
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.[2]	131-32
Cotton dust standards	P. L. 95-448	n.c.	28-31
Mono Basin National Forest Scenic Area study	P. L. 98-425	16 U.S.C. 543d	160-61
Solar energy research information system	P. L. 95-113	7 U.S.C. 3251	23-24
Air pollution			
Air quality modeling	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
Air quality standards, review of	P. L. 95-95	42 U.S.C. 7409(d)(2)	49-54
Emission standards	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
	P. L. 95-95	42 U.S.C. 7521 note	49-54
Ozone protection	P. L. 95-95	42 U.S.C. 7453(d)	49-54
Suspended particulate matter	P. L. 95-95	n.l.c.	49-54
Air quality			
Airline cabins	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Modeling	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
Standards	P. L. 95-95	42 U.S.C. 7409(d)(2)	49-54
National Commission on	P. L. 95-95	n.l.c.	49-54
Aircraft safety			
Cabin air quality	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Wind shear hazards	P. L. 97-369	n.c.	187-88
Alaska, surface coal mine study	P. L. 95-87	30 U.S.C. 1298	148-52
Albert Einstein Memorial	P. L. 95-625	16 U.S.C. 431 note	14-15
Alcohol, Drug Abuse, and Mental Health Administration			
Biomedical and behavioral research personnel study	P. L. 93-348	42 U.S.C. 289*l*-2	121-23
	Amended by P. L. 94-278	42 U.S.C. 289*l*-2	121-23
	and P. L. 95-622	42 U.S.C. 289*l*-2	121-23
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
American Association of State Highway and Transportation Officials, highway resurfacing study	P. L. 97-424	23 U.S.C. 109 note	199-202

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[1] n.c. = not codified

[2] n.l.c = no longer codified

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Antibiotics in animal feed	P. L. 95-448	n.c.	28-31
	P. L. 96-108	n.c.	32-33
Army, Department of the, Washington metropolitan area water resources needs study	P. L. 93-251	n.c.	145-46
Atmospheric carbon dioxide, fuel combustion	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
Atmospheric sciences			
Climate changes, fuel combustion	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
Sun-Earth interactions	P. L. 98-52	n.c.	181-83
Atolls, Pacific Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Atomic Energy Commission, Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Automobiles. *See* Motor vehicles			
Aviation safety. *See* Aircraft safety			

B

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Behavioral research, personnel needs and training	P. L. 93-348	42 U.S.C. 289*l*-2	121-23
Amended by	P. L. 94-278	42 U.S.C. 289*l*-2	121-23
and	P. L. 95-622	42 U.S.C. 289*l*-2	121-23
Bikini atoll, Marshall Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Biological effects, ionizing radiation			
Exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Research	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Biomedical research, personnel needs and training	P. L. 93-348	42 U.S.C. 289*l*-2	121-23
Amended by	P. L. 94-278	42 U.S.C. 289*l*-2	121-23
and	P. L. 95-622	42 U.S.C. 289*l*-2	121-23
Birth defects, hazard from consumer products	P. L. 97-35	15 U.S.C. 2077	82-84
Brookings Institution, effluent limitations study	P. L. 92-500	33 U.S.C. 1325(a),(c),(e)	41-43
Building sciences and technology	P. L. 93-383	12 U.S.C. 1701j-2	61-63
Bureau of...*See other part of name*			
Burros, wild, management	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
	P. L. 98-473	n.c.	162-63
Buses, citizen band radios	P. L. 97-261	49 U.S.C. 11111	197-98
Byssinosis, cotton dust standards	P. L. 95-448	n.c.	28-31

C

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
California, ecology of Mono Basin National Forest Scenic Area	P. L. 98-425	16 U.S.C. 543d	160-61
Cancer, hazard from consumer products	P. L. 97-35	15 U.S.C. 2077	82-84
Capitol Reef National Park, grazing phaseout study	P. L. 97-341	16 U.S.C. 273b note	155-56

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Carbon dioxide, atmospheric, fuel combustion	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
Carbon monoxide emissions	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
Carcinogens			
In foods	P. L. 95-203	21 U.S.C. 343 note	25-26
Risk assessment	P. L. 96-528	n.c.	80-81
Cars. *See* Motor vehicles			
CB radios, use on buses	P. L. 97-261	49 U.S.C. 11111	197-98
Center for...*See other part of name*			
Children, lead poisoning	P. L. 94-317	42 U.S.C. 4841(3)(B)(i)	69-70
Chlorofluorocarbons, ozone protection	P. L. 95-95	42 U.S.C. 7453(d)	49-54
Chronic Hazards Advisory Panels	P. L. 97-35	15 U.S.C. 2077	82-84
Citizen band radios, use on buses	P. L. 97-261	49 U.S.C. 11111	197-98
Climate change, fuel combustion	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
Coal			
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Alaskan surface coal mine study	P. L. 95-87	30 U.S.C. 1298	148-52
Conversion, environmental effects	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
University coal research laboratories	P. L. 95-87	30 U.S.C. 1311	148-52
Amended by	P. L. 95-617	30 U.S.C. 1311	148-52
Color additives, national advisory committee	P. L. 86-618	21 U.S.C. 376(b)(5)(C)(i),(D)	21-22
Commerce, Department of, Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Commission on the Evaluation of Pain	P. L. 98-460	42 U.S.C. 423 and note	139-40
Committee of Scientific Advisors on Marine Mammals	P. L. 92-522	16 U.S.C. 1403(a)	167-69
Committee on Mining and Mineral Resources	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Congressional Budget Office, highway resurfacing study	P. L. 97-424	23 U.S.C. 109 note	199-202
Consumer Product Safety Commission			
Chronic Hazards Advisory Panels	P. L. 97-35	15 U.S.C. 2077	82-84
Health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b (d)	74-76
Lead-based paint poisoning prevention	P. L. 94-317	42 U.S.C. 4841(3)(B)(i)	69-70
Consumer products, chronic hazards	P. L. 97-35	15 U.S.C. 2077	82-84
Contaminant levels, drinking water	P. L. 93-523	42 U.S.C. 300g-1(b),(e)	44-48
Amended by	P. L. 95-190	42 U.S.C. 300g-1(b),(e)	44-48
Cooperative State Research Service, solar energy research information system	P. L. 95-113	7 U.S.C. 3251	23-24
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Cosmetics, color additives	P. L. 86-618	21 U.S.C. 376(b)(5)(C)(i),(D)	21-22
Cotton dust standards	P. L. 95-448	n.c.	28-31
Council on...*See other part of name*			

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
D			
Defense, Department of			
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Herbicides and defoliation study	P. L. 91-441	10 U.S.C. 2358 note	87-88
Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
Low-level ionizing radiation study	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Marshall Islands radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
See also Army, Department of the			
Defoliation program, South Vietnam	P. L. 91-441	10 U.S.C. 2358 note	87-88
Department of...*See other part of name*			
Developing countries, international health activities	P. L. 95-83	42 U.S.C. 242*l* note	110-11
Digestive diseases research, coordinating committee	P. L. 94-562	n.l.c.	131-32
Disability, pain evaluation	P. L. 98-460	42 U.S.C. 423 and note	139-40
Disease Control, Center for			
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Lead-based paint poisoning prevention	P. L. 94-317	42 U.S.C. 4841(3)(B)(i)	69-70
Disposal technology, hazardous wastes	P. L. 96-229	n.c.	99-100
District of Columbia, Albert Einstein Memorial	P. L. 95-625	16 U.S.C. 431 note	14-15
Double bottom trucks, effects on highways	P. L. 97-424	49 U.S.C. App. 2315 note	199-202
Drinking water, maximum contaminant levels	P. L. 93-523	42 U.S.C. 300g-1(b),(e)	44-48
Amended by	P. L. 95-190	42 U.S.C. 300g-1(b),(e)	44-48
Drugs			
Antibiotics in animal feed	P. L. 95-448	n.c.	28-31
	P. L. 96-108	n.c.	32-33
Color additives	P. L. 86-618	21 U.S.C. 376(b)(5)(C)(i), (D)	21-22
E			
Ecology/ecosystems management			
Capitol Reef National Park, grazing	P. L. 97-341	16 U.S.C. 273b note	155-56
Herbicide use	P. L. 91-441	10 U.S.C. 2358 note	87-88
Mono Basin National Forest Scenic Area	P. L. 98-425	16 U.S.C. 543d	160-61
See also Wildlife management			
Economic Advisers, Council of, health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b(d)	74-76

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Education			
Medical	P. L. 97-35	42 U.S.C. 292h note	127-28
Nursing	P. L. 96-76	42 U.S.C. 296 note	124-26
Effluent limitations	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
Einstein, Albert, Memorial	P. L. 95-625	16 U.S.C. 431 note	14-15
Emergency medical services, interagency committee	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
Emission standards			
Adherence, feasibility	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
Automobile performance effects	P. L. 93-135	n.c.	93-96
Health effects	P. L. 95-95	42 U.S.C. 7521 note	49-54
Implementation and changes	P. L. 95-95	42 U.S.C. 7521 note	49-54
Energy crisis, effect of environmental regulations	P. L. 93-135	n.c.	93-96
Energy, Department of			
Low-level ionizing radiation study	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Marshall Islands radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
University coal research laboratories	P. L. 95-87	30 U.S.C. 1311	148-52
Amended by	P. L. 95-617	30 U.S.C. 1311	148-52
See also Energy Research and Development Administration			
Energy development/use			
Coal	P. L. 95-87	30 U.S.C. 1298, 1311, 1315	148-52
Environmental effects	P. L. 95-87	30 U.S.C. 1298, 1299	148-52
	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
Solar energy in agriculture	P. L. 95-113	7 U.S.C. 3251	23-24
Energy Research and Development Administration			
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Solar energy research information system	P. L. 95-113	7 U.S.C. 3251	23-24
See also Energy, Department of			
Enewetak atoll, Marshall Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Environment-related health effects			
Airline cabin air quality	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Costs	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Cotton dust standards	P. L. 95-448	n.c.	28-31
Drinking water contaminants	P. L. 93-523	42 U.S.C. 300g-1(b),(e)	44-48
Amended by	P. L. 95-190	42 U.S.C. 300g-1(b),(e)	44-48
Lead-based paint	P. L. 94-317	42 U.S.C. 4841(3)(B)(i)	69-70
Radiation	P. L. 86-373	42 U.S.C. 2021 note	67-68
	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Risk assessment	P. L. 96-528	n.c.	80-81
See also Occupational safety and health			
Environmental programs			
Coordination of efforts	P. L. 95-477	42 U.S.C 4366 note	97-98
Review of	P. L. 93-135	n.c.	93-96

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Environmental protection			
Alaskan surface coal mine study	P. L. 95-87	30 U.S.C. 1298	148-52
Hazardous waste disposal	P. L. 96-229	n.c.	99-100
Herbicide use	P. L. 91-441	10 U.S.C. 2358 note	87-88
Information and decisionmaking	P. L. 93-135	n.c.	93-96
Pesticide use	P. L. 92-516	7 U.S.C. 136d(b),(d)	89-92
Environmental Protection Agency			
Air quality modeling conference	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
Air quality standards	P. L. 95-95	42 U.S.C. 7409(d)(2)	49-54
Coordination of federal environment programs	P. L. 95-477	42 U.S.C. 4366 note	97-98
Effluent limitations study	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
Emission standards, implementation and review	P. L. 95-95	42 U.S.C. 7521 note	49-54
Health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Low-level ionizing radiation study	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Motor vehicle emission standards	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
National drinking water regulations	P. L. 93-523	42 U.S.C. 300g-1(b),(e)	44-48
Amended by	P. L. 95-190	42 U.S.C. 300g-1(b),(e)	44-48
Non-nuclear hazardous waste disposal study	P. L. 96-229	n.c.	99-100
Ozone protection studies	P. L. 95-95	42 U.S.C. 7453(d)	49-54
Particulate matter study	P. L. 95-95	n.l.c.	49-54
Pesticides, public hearings and scientific review	P. L. 92-516	7 U.S.C. 136d(b),(d)	89-92
Program review	P. L. 93-135	n.c.	93-96
Environmental Quality, Council on			
Health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Marine Mammal Commission	P. L. 92-522	16 U.S.C. 1401(a),(b)(1)	167-69
Amended by	P. L. 98-364	16 U.S.C. 1401(a),(b)(1)	167-69
Surface mining study	P. L. 95-87	30 U.S.C. 1299	148-52
F			
Federal Aviation Administration			
Airline cabin air quality study	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Wind shear study	P. L. 97-369	n.c.	187-88
Federal Communications Commission, Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Fertilizers, hazards to humans	P. L. 93-135	n.c.	93-96
Fish and Wildlife Service, wild horses and burros management	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
Food and Drug Administration			
Antibiotics in animal feed	P. L. 95-448	n.c.	28-31
	P. L. 96-108	n.c.	32-33
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Risk assessment study	P. L. 96-528	n.c.	80-81

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Food safety			
Carcinogens	P. L. 95-203	21 U.S.C. 343 note	25-26
Color additives	P. L. 86-618	21 U.S.C. 376(b)(5)(C)(i),(D)	21-22
Saccharin	P. L. 95-203	21 U.S.C. 343 note	25-26
Toxic substances	P. L. 95-203	21 U.S.C. 343 note	25-26
Forest Service, Mono Basin National Forest Scenic Area study	P. L. 98-425	16 U.S.C. 543d	160-61
Fossil fuel combustion, environmental effects	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
G			
Gene mutations, hazard from consumer products	P. L. 97-35	15 U.S.C. 2077	82-84
Geological Survey. *See* U.S. Geological Survey			
Grazing, Capitol Reef National Park	P. L. 97-341	16 U.S.C. 273b note	155-56
H			
Handicapped people, rehabilitation	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Hazardous waste disposal	P. L. 96-229	n.c.	99-100
Health and Human Services, Department of			
Council on Health Care Technology	P. L. 98-551	42 U.S.C. 242n	112-14
Evaluation of pain	P. L. 98-460	42 U.S.C. 423 and note	139-40
Neurological research report	P. L. 96-538	42 U.S.C. 289 note	133-34
Physician study	P. L. 97-35	42 U.S.C. 292h note	127-28
Risk assessment study	P. L. 96-528	n.c.	80-81
See also Health, Education, and Welfare, Department of			
Health care delivery			
Emergency medical services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
International activities	P. L. 95-83	42 U.S.C. 242*l* note	110-11
Quality assurance programs	P. L. 93-222	42 U.S.C. 300e note	107-08
Rehabilitation, handicapped people	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Veterans' Administration hospitals	P. L. 93-82	n.l.c.	117-18
See also Quality of health care			
Health care technologies, rehabilitation of the handicapped	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Health Care Technology, Council on	P. L. 98-551	42 U.S.C. 242n	112-14
Health, Education, and Welfare, Department of			
Advisory committee on color additives	P. L. 86-618	21 U.S.C. 376(b)(5)(C)(i),(D)	21-22
Biomedical and behavioral research personnel study	P. L. 93-348	42 U.S.C. 289*l*-2	121-23
Amended by	P. L. 94-278	42 U.S.C. 289*l*-2	121-23
and	P. L. 95-622	42 U.S.C. 289*l*-2	121-23
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Health care quality assurance programs study	P. L. 93-222	42 U.S.C. 300e note	107-08
Health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
International health activities study	P. L. 95-83	42 U.S.C. 242*l* note	110-11
Lead-based paint poisoning prevention	P. L. 94-317	42 U.S.C. 4841(3)(B)(i)	69-70
Low-level ionizing radiation study	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Marshall Islands radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Nursing study	P. L. 96-76	42 U.S.C. 296 note	124-26
Payment for physicians in teaching hospitals study	P. L. 93-233	42 U.S.C. 1395x note	119-20
Rehabilitation technologies for the handicapped	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Saccharin study	P. L. 95-203	21 U.S.C. 343 note	25-26
See also Health and Human Services, Department of			
Health effects			
Airline cabin air quality	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Antibiotics in animal feed	P. L. 95-448	n.c.	28-31
	P. L. 96-108	n.c.	32-33
Consumer products	P. L. 97-35	15 U.S.C. 2077	82-84
Cotton dust	P. L. 95-448	n.c.	28-31
Drinking water contaminants	P. L. 93-523	42 U.S.C. 300g-1(b),(e)	44-48
Amended by	P. L. 95-190	42 U.S.C. 300g-1(b),(e)	44-48
Emissions	P. L. 95-95	42 U.S.C. 7521 note	49-54
Environmental pollution	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Radiation	P. L. 86-373	42 U.S.C. 2021 note	67-68
	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Saccharin	P. L. 95-203	21 U.S.C. 343 note	25-26
Toxic substances in foods	P. L. 95-203	21 U.S.C. 343 note	25-26
Health Resources Administration, Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Health Services Administration, Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Herbicides			
Environmental dangers	P. L. 91-441	10 U.S.C. 2358 note	87-88
Human hazards	P. L. 93-135	n.c.	93-96
Highway safety			
Double bottom trucks	P. L. 97-424	23 U.S.C. 2315 note	199-202
National Maximum Speed Limit	P. L. 97-424	23 U.S.C. 154 note	199-202
Resurfacing standards	P. L. 97-424	23 U.S.C. 109 note	199-202
Trauma research	P. L. 98-63	n.c.	135-36
	P. L. 98-78	n.c.	137-38
Horses, wild, management	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
	P. L. 98-473	n.c.	162-63

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Hospitals			
Teaching hospitals, payment of physicians	P. L. 93-233	42 U.S.C. 1395x note	119-20
Veterans' Administration hospitals, personnel requirements	P. L. 93-82	n.l.c.	117-18
Hot dip galvanizing process, highway resurfacing	P. L. 97-424	23 U.S.C. 109 note	199-202
Housing technology	P. L. 93-383	12 U.S.C. 1701j-2	61-63
Hydrocarbon emissions	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
	P. L. 95-95	n.l.c.	49-54
I			
Information systems/dissemination			
Health care technologies	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
	P. L. 98-551	42 U.S.C. 242n	112-14
Health effects of air travel	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Solar energy in agriculture	P. L. 95-113	7 U.S.C. 3251	23-24
Institute of Medicine			
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
Environment-related health effects	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Health care quality assurance programs	P. L. 93-222	42 U.S.C. 300e note	107-08
Neurological research	P. L. 96-538	42 U.S.C. 289 note	133-34
Nursing education and practice	P. L. 96-76	42 U.S.C. 296 note	124-26
Physician supply and salaries	P. L. 97-35	42 U.S.C. 292h note	127-28
Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
Interior, Department of the			
Advisory Committee on Mining and Mineral Resources	P. L. 95-87	30 U.S.C. 1229	148-52
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Alaskan surface coal mine study	P. L. 95-87	30 U.S.C. 1298	148-52
Albert Einstein Memorial	P. L. 95-625	16 U.S.C. 431 note	14-15
Committee on Mining and Mineral Resources Research	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Grazing phaseout in Capitol Reef National Park	P. L. 97-341	16 U.S.C. 273b note	155-56
Marshall Islands radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Wild horses and burros management	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
	P. L. 98-473	n.c.	162-63
International assessment, carbon dioxide in the atmosphere	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
International health activities study	P. L. 95-83	42 U.S.C. 242*l* note	110-11
International Solar Polar Mission, spacecraft options	P. L. 97-12	n.c.	179-80
Interstate Commerce Commission, citizen band radios on buses study	P. L. 97-261	49 U.S.C. 11111	197-98
Ionizing radiation. *See* Radiation			

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
J			
Justice, Department of, Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
	Amended by P. L. 94-573	n.l.c.	105-06
L			
Labor, Department of			
Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b(d)	74-76
See also Occupational Safety and Health Administration			
Land Management, Bureau of			
Grazing phaseout in Capitol Reef National Park	P. L. 97-341	16 U.S.C. 273b note	155-56
Wild horses and burros management	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
	P. L. 98-473	n.c.	162-63
Lead-based paint poisoning	P. L. 94-317	42 U.S.C. 4841(3)(B)(i)	69-70
Low-altitude wind shear, aviation hazard	P. L. 97-369	n.c.	187-88
Low-level ionizing radiation. *See* Radiation			
M			
Management and Budget, Office of, coordination of federal environmental programs	P. L. 95-477	42 U.S.C. 4366 note	97-98
Manpower			
Biomedical and behavioral research personnel	P. L. 93-348	42 U.S.C. 289*l*-2	121-23
	Amended by P. L. 94-278	42 U.S.C. 289*l*-2	121-23
	and P. L. 95-622	42 U.S.C. 289*l*-2	121-23
Environmental programs	P. L. 93-135	n.c.	93-96
Nursing	P. L. 96-76	42 U.S.C. 296 note	124-26
Physician supply	P. L. 97-35	42 U.S.C. 292h note	127-28
Teaching hospitals	P. L. 93-233	42 U.S.C. 1395x note	119-20
Transportation	P. L. 97-424	23 U.S.C. 101 note	199-202
Veterans' Administration hospitals	P. L. 93-82	n.l.c.	117-18
Marine earth sciences	P. L. 96-516	n.c.	170-71
Marine environment, waste disposal	P. L. 93-135	n.c.	93-96
Marine Mammal Commission	P. L. 92-522	16 U.S.C. 1401(a),(b)(1)	167-69
	Amended by P. L. 98-364	16 U.S.C. 1401(a),(b)(1)	167-69
Marshall Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Maryland, Sixes Bridge Dam and Lake, Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
Medical technology. *See* Health care technology			
Medicare-Medicaid, reimbursement policies in teaching hospitals	P. L. 93-233	42 U.S.C. 1395x note	119-20

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Mineral resources research	P. L. 95-87	30 U.S.C. 1229, 1298, 1299, 1311, 1315	148-52
	Amended by P. L. 95-617	30 U.S.C. 1311	148-52
	and P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Mines, Bureau of			
Advisory Committee on Mining and Mineral Research	P. L. 95-87	30 U.S.C. 1229	148-52
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Committee on Mining and Mineral Resources Research	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Mining research	P. L. 95-87	30 U.S.C. 1229, 1298, 1299, 1311, 1315	148-52
	Amended by P. L. 95-617	30 U.S.C. 1311	148-52
	and P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Modeling, air quality	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
Mono Basin National Forest Scenic Area, ecology	P. L. 98-425	16 U.S.C. 543d	160-61
Motor vehicles			
Citizen band radios	P. L. 97-261	49 U.S.C. 11111	197-98
Emission standards	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
	P. L. 93-135	n.c.	93-96
National Maximum Speed Limit	P. L. 97-424	23 U.S.C. 154 note	199-202
Safety belt use	P. L. 95-599	23 U.S.C. 402 note	195-96
Trauma research	P. L. 98-63	n.c.	135-36
	P. L. 98-78	n.c.	137-38
Mutations, hazard from consumer products	P. L. 97-35	15 U.S.C. 2077	82-84

N

National Academy of Engineering			
Advisory Committee on Mining and Mineral Research	P. L. 95-87	30 U.S.C. 1229	148-52
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Alaskan surface coal mine study	P. L. 95-87	30 U.S.C. 1298	148-52
Committee on Mining and Mineral Resources Research	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
National Institute of Building Sciences	P. L. 93-383	12 U.S.C. 1701j-2	61-63
National study commission on effluent limitations	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
Sun-Earth interactions study	P. L. 98-52	n.c.	181-83
University coal research laboratories	P. L. 95-87	30 U.S.C. 1311	148-52
	Amended by P. L. 95-617	30 U.S.C. 1311	148-52
Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
National Academy of Sciences, Act of Incorporation and amendments		36 U.S.C. 251, 252, 253, 254	3-6
National Aeronautics and Space Administration			
Solar polar mission spacecraft options	P. L. 97-12	n.c.	179-80
Sun-Earth interactions study	P. L. 98-52	n.c.	181-83

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
National Bureau of Standards, air quality modeling conference	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
National Commission on Air Quality	P. L. 95-95	n.l.c.	49-54
National Commission on Water Quality	P. L. 92-500	13 U.S.C 1311(b)(2), 1325(a),(c),(e)	41-43
National Committee on Radiation Protection and Measurement	P. L. 86-373	42 U.S.C. 2021 note	67-68
National forests, ecology of Mono Basin National Forest Scenic Area	P. L. 98-425	16 U.S.C. 543d	160-61
National Highway Traffic Safety Administration, trauma research	P. L. 98-63	n.c.	135-36
	P. L. 98-78	n.c.	137-38
National Institute of Arthritis, Metabolism, and Digestive Diseases and Nutrition, Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
National Institute of Building Sciences	P. L. 93-383	12 U.S.C. 1701j-2	61-63
National Institute of Ecology, effluent limitations study	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
National Institute of Occupational Safety and Health, Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
National Institutes of Health			
Biomedical and behavioral research personnel study	P. L. 93-348	42 U.S.C. 289l-2	121-23
Amended by	P. L. 94-278	42 U.S.C. 289l-2	121-23
and	P. L. 95-622	42 U.S.C. 289l-2	121-23
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32
National Maximum Speed Limit, benefits	P. L. 97-424	23 U.S.C. 154 note	199-202
National Medal of Science			
Award and presentation	E. O. 11287	42 U.S.C. 1881(2), (3a)	10-11
Establishment	P. L. 86-209	42 U.S.C. 1880, 1881	9
National Oceanic and Atmospheric Administration, air quality modeling conference	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
National Park Service, grazing phaseout in Capitol Reef National Park	P. L. 97-341	16 U.S.C. 273b note	155-56
National parks			
Albert Einstein Memorial	P. L. 95-625	16 U.S.C. 431 note	14-15
Capitol Reef National Park, grazing phaseout	P. L. 97-341	16 U.S.C. 273b note	155-56
National Research Council			
National Study Commission on Effluent Limitations	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
Perpetuation, functions, and government representation	E. O. 2859	36 U.S.C. 253 note	7-9
Amended by	E. O. 10668	36 U.S.C. 253 note	7-9

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Postperformance evaluation of scientific research	P. L. 96-526	n.c.	16-17
Sun-Earth interactions study	P. L. 98-52	n.c.	181-83
National Science Board, nominations	P. L. 90-407	42 U.S.C. 1863(a),(b),(c)	12-13
National Science Foundation			
Advisory Committee on Mining and Mineral Research	P. L. 95-87	30 U.S.C. 1229	148-52
Air quality modeling conference	P. L. 95-95	42 U.S.C. 7620(a),(b)	49-54
Committee on Mining and Mineral Resources Research	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
Marine Mammal Commission	P. L. 92-522	16 U.S.C. 1401(a),(b)(1)	167-69
Amended by	P. L. 98-364	16 U.S.C. 1401(a),(b)(1)	167-69
National Medal of Science	P. L. 86-209	42 U.S.C. 1880, 1881	9
National Science Board	P. L. 90-407	42 U.S.C. 1863(a),(b),(c)	12-13
Ocean margin drilling project, marine earth sciences	P. L 96-516	n.c.	170-71
Postperformance evaluation of scientific research	P. L. 96-526	n.c.	16-17
Rehabilitation technologies for the handicapped	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Underwater neutrinos, review of research	P. L. 98-371	n.c.	175-76
National Study Commission on Effluent Limitations	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
National System of Interstate and Defense Highways, effects of double bottom trucks	P. L. 97-424	23 U.S.C. 2315 note	199-202
National Transportation Safety Board, highway resurfacing study	P. L. 97-424	23 U.S.C. 109 note	199-202
Natural resources. *See specific resources*			
Neurological research	P. L. 96-538	42 U.S.C. 289 note	133-34
Neutrinos, underwater	P. L. 98-371	n.c.	175-76
Nitrogen oxide emissions	P. L. 91-604	42 U.S.C. 7521(b),(c)	37-40
	P. L. 95-95	n.l.c.	49-54
Nuclear Regulatory Commission, low-level ionizing radiation study	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Nuclear weapons testing, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Nursing education and practice	P. L. 96-76	42 U.S.C. 296 note	124-26

O

Occupational safety and health			
Airline cabin air quality	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Cotton dust standards	P. L. 95-448	n.c.	28-31
Occupational Safety and Health Administration, cotton dust standards	P. L. 95-448	n.c.	28-31

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Office of...*See other part of name*			
Ocean drilling, marine earth sciences	P. L. 96-516	n.c.	170-71
Open pit mining, non-coal minerals	P. L. 95-87	30 U.S.C. 1299	148-52
Ozone protection	P. L. 95-95	42 U.S.C. 7453(d)	49-54
P			
Pacific Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Pain evaluation research	P. L. 98-460	42 U.S.C. 423 and note	139-40
Payment. *See* Salaries			
Personnel. *See* Manpower			
Pesticides			
Environmental effects	P. L. 92-516	7 U.S.C. 136d(b),(d)	89-92
Human hazards	P. L. 93-135	n.c.	93-96
Photochemical oxidants, emission standards	P. L. 95-95	42 U.S.C. 7521 note	49-54
Physician distribution			
Supply and salary effects	P. L. 97-35	42 U.S.C. 292h note	127-28
Teaching hospitals	P. L. 93-233	42 U.S.C. 1395x note	119-20
See also Nursing education and practice			
Physicians			
Supply and salary	P. L. 97-35	42 U.S.C. 292h note	127-28
Teaching hospitals, salaries	P. L. 93-233	42 U.S.C. 1395x note	119-20
Veterans' Administration hospitals	P. L. 93-82	n.l.c.	117-18
Physics, underwater neutrinos	P. L. 98-371	n.c.	175-76
Pollution, air. *See* Air pollution			
Pollution control, costs	P. L. 93-135	n.c.	93-96
Pollution, health effects. *See* Environment-related health effects			
Pollution, water. *See* Water pollution			
Population dynamics, wild horses and burros	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
	P. L. 98-473	n.c.	162-63
Postperformance evaluation of scientific research	P. L. 96-526	n.c.	16-17
Potomac estuary, Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
President's Committee on the National Medal of Science	E. O. 11287	42 U.S.C. 1881(2),(3a)	10-11
Public health. *See* Health effects			
Public Health Service, Marshall Islands radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Q			
Quality of health care			
Assessment systems	P. L. 93-222	42 U.S.C. 300e note	107-08
Physician supply and salary effects	P. L. 97-35	42 U.S.C. 292h note	127-28
Veterans' Administration hospitals	P. L. 93-82	n.l.c.	117-18

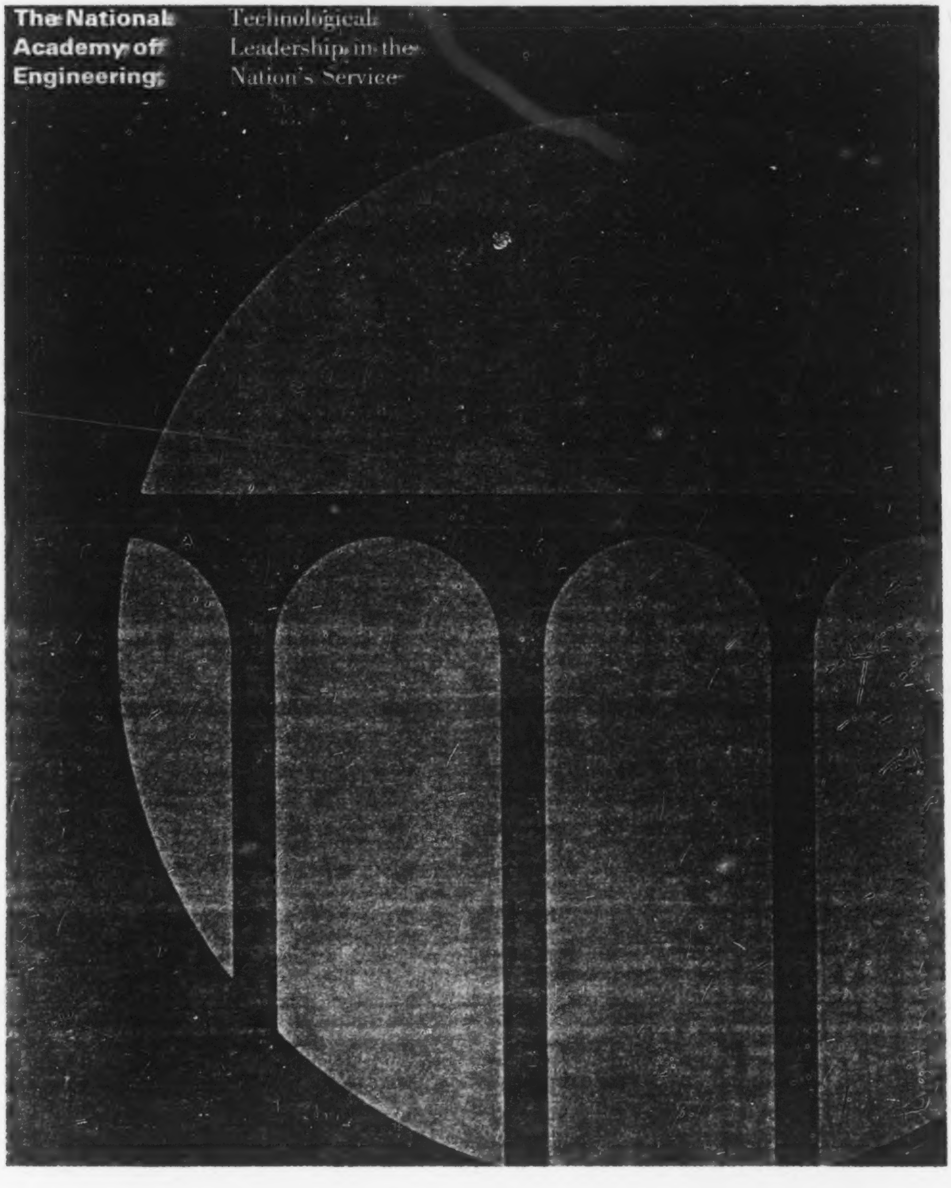
	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
R			
Radiation			
Biological effects research	P. L. 95-622	42 U.S.C. 241(b)(2)	71-73
Exposure compensation, nuclear testing	P. L. 96-205	48 U.S.C. 1681 notes	77-79
Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Radios, citizen band, use on buses	P. L. 97-261	49 U.S.C. 11111	197-98
Rangeland management, wild horses and burros	P. L. 95-514 P. L. 98-473	16 U.S.C. 1333(b)(1),(b)(3) n.c.	153-54 162-63
Reclamation, minerals	P. L. 95-87	30 U.S.C. 1299	148-52
Rehabilitation Engineering Research Centers	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Rehabilitation, handicapped individuals	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Rehabilitation, highways	P. L. 97-424	23 U.S.C. 109 note	199-202
Rehabilitation Services Administration, advanced medical technologies	P. L. 93-112	29 U.S.C. 762(b)(2)	103-04
Research, scientific, postperformance evaluation	P. L. 96-526	n.c.	16-17
Resources. *See specific resources*			
Respiratory diseases, cotton dust standards	P. L. 95-448	n.c.	28-31
Resurfacing, highways	P. L. 97-424	23 U.S.C. 109 note	199-202
Risk assessment, carcinogens and other public health hazards	P. L. 96-528	n.c.	80-81
Rodenticides, hazards to humans	P. L 93-135	n.c.	93-96
Rongelap atoll, Marshall Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
S			
Saccharin, health risks and benefits	P. L. 95-203	21 U.S.C. 343 note	25-26
Safety belts, encouragement of use	P. L. 95-599	23 U.S.C. 402 note	195-96
Salaries, physicians			
Effect on distribution	P. L. 97-35	42 U.S.C. 292h note	127-28
Teaching hospitals	P. L. 93-233	42 U.S.C. 1395x note	119-20
Science Adviser, National Medal of Science	E. O. 11287	42 U.S.C. 1881(2),(3a)	10-11
Science and Technology Policy, Office of, carbon dioxide in the atmosphere study	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
Scientific research, postperformance evaluation	P. L. 96-526	n.c	16-17
Sixes Bridge Dam and Lake, Maryland, Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
Sludge management	P. L. 93-135	n.c.	93-96
Smithsonian Institution, Marine Mammal Commission	P. L. 92-522	16 U.S.C. 1401(a),(b)(1)	167-69
Amended by	P. L. 98-364	16 U.S.C. 1401(a),(b)(1)	167-69
Social Security Administration			
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Payment for physicians in teaching hospitals study	P. L. 93-233	42 U.S.C. 1395x note	119-20
Solar energy, agriculture	P. L. 95-113	7 U.S.C. 3251	23-24
Solar polar mission, spacecraft options	P. L. 97-12	n.c.	179-80
Space sciences			
Solar polar mission	P. L. 97-12	n.c.	179-80
Sun-Earth interactions	P. L. 98-52	n.c.	181-83
Spacecraft options, solar polar mission	P. L. 97-12	n.c.	179-80
Special Assistant to the President for Science and Technology, Federal Radiation Council	P. L. 86-373	42 U.S.C. 2021 note	67-68
Speed limit, benefits	P. L. 97-424	23 U.S.C. 154 note	199-202
Spinal cord regeneration	P. L. 96-538	42 U.S.C. 289 note	133-34
South Vietnam, defoliation program	P. L. 91-441	10 U.S.C. 2358 note	87-88
State mining and mineral resources research institutes	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
Steel, hot dip galvanizing process, highway resurfacing	P. L. 97-424	23 U.S.C. 109 note	199-202
Stratosphere, ozone protection	P. L. 95-95	42 U.S.C. 7453(d)	49-54
Sun-Earth interactions, scientific understanding	P. L. 98-52	n.c.	181-83
Surface mining			
Alaskan surface coal mine study	P. L. 95-87	30 U.S.C. 1298	148-52
Non-coal minerals	P. L. 95-87	30 U.S.C. 1299	148-52
Suspended particulates, health effects	P. L. 95-95	n.l.c.	49-54
Sweeteners, non-nutritive, health risks and benefits	P. L. 95-203	21 U.S.C. 343 note	25-26
Synthetic fuels, environmental effects	P. L. 96-294	42 U.S.C. 8911, 8912	55-57
T			
Teaching hospitals, payment of physicians	P. L. 93-233	42 U.S.C. 1395x note	119-20
Technology Assessment, Office of, Council on Health Care Technology	P. L. 98-551	42 U.S.C. 242n	112-14
Toxic substances			
Consumer products	P. L. 97-35	15 U.S.C. 2077	82-84
Foods	P. L. 95-203	21 U.S.C. 343 note	25-26
Training programs, biomedical and behavioral research personnel	P. L. 93-348	42 U.S.C. 289*l*-2	121-23
Transportation, Department of			
Airline cabin air quality study	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Citizen band radios on buses, study	P. L. 97-261	49 U.S.C. 11111	197-98
Double bottom trucks, monitoring the effects of	P. L. 97-424	23 U.S.C. 2315 note	199-202
Highway resurfacing study	P. L. 97-424	23 U.S.C. 109 note	199-202
Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Manpower study	P. L. 97-424	23 U.S.C. 101 note	199-202
National speed limit study	P. L. 97-424	23 U.S.C. 154 note	199-202
Safety belt study	P. L. 95-599	23 U.S.C. 402 note	195-96
Trauma research	P. L. 98-63	n.c.	135-36
	P. L. 98-78	n.c.	137-38
Wind shear study	P. L. 97-369	n.c.	187-88
Transportation manpower, needs assessment	P. L. 97-424	23 U.S.C. 101 note	199-202
Transportation noise abatement	P. L. 93-135	n.c.	93-96
Transportation safety, air			
Cabin air quality	P. L. 98-466	49 U.S.C. App. 1303 note	189-91
Wind shear hazards	P. L. 97-369	n.c.	187-88
Transportation safety, land			
Citizen band radios on buses	P. L. 97-261	49 U.S.C. 11111	197-98
Double bottom trucks	P. L. 97-424	23 U.S.C. 2315 note	199-202
Highway resurfacing standards	P. L. 97-424	23 U.S.C. 109 note	199-202
National Maximum Speed Limit	P. L. 97-424	23 U.S.C. 154 note	199-202
Safety belt use	P. L. 95-599	23 U.S.C. 402 note	195-96
Trauma research	P. L. 98-63	n.c.	135-36
	P. L. 98-78	n.c.	137-38
Trauma, comprehensive research program	P. L. 98-63	n.c.	135-36
	P. L. 98-78	n.c.	137-38
Trucks, double bottom, effects on highways	P. L. 97-424	23 U.S.C. 2315 note	199-202
U			
Underwater neutrinos	P. L. 98-371	n.c.	175-76
University coal research laboratories	P. L. 95-87	30 U.S.C. 1311	148-52
Amended by	P. L. 95-617	30 U.S.C. 1311	148-52
University mining and minerals resources research institutes	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
U.S. Geological Survey			
Advisory Committee on Mining and Mineral Research	P. L. 95-87	30 U.S.C. 1229	148-52
Advisory Council on Coal Research	P. L. 95-87	30 U.S.C. 1315	148-52
Committee on Mining and Mineral Resources Research	P. L. 98-409	30 U.S.C. 1221, 1229, 1230	157-59
U.S.S.R., underwater neutrinos, review of research	P. L. 98-371	n.c.	175-76
Utah, Capitol Reef National Park, grazing phaseout	P. L. 97-341	16 U.S.C. 273b note	155-56
Utirik atoll, Marshall Islands, radiation exposure compensation	P. L. 96-205	48 U.S.C. 1681 notes	77-79
V			
Vehicles. *See* Motor vehicles			
Verona Dam and Lake, Virginia, Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
Veterans' Administration			
Coordinating Committee for Digestive Diseases	P. L. 94-562	n.l.c.	131-32

	PUBLIC LAW	UNITED STATES CODE CITATION	PAGES
Interagency Committee on Emergency Medical Services	P. L. 93-154	n.l.c.	105-06
Amended by	P. L. 94-573	n.l.c.	105-06
VA hospitals, personnel and resource requirements study	P. L. 93-82	n.l.c.	117-18
Vietnam, defoliation program	P. L. 91-441	10 U.S.C. 2358 note	87-88
Virginia, Verona Dam and Lake, Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
W			
Wage and Price Stability, Council on, health costs of environment-related diseases	P. L. 95-623	42 U.S.C. 242b(d)	74-76
Washington metropolitan area water resource needs	P. L. 93-251	n.c.	145-46
Waste disposal			
Hazardous wastes	P. L. 96-229	n.c.	99-100
Marine environment	P. L. 93-135	n.c.	93-96
Sludge	P. L. 93-135	n.c.	93-96
Water pollution			
Effluent limitations	P. L. 92-500	13 U.S.C. 1311(b)(2), 1325(a),(c),(e)	41-43
Maximum contaminant levels	P. L. 93-523	42 U.S.C. 300g-1(b),(e)	44-48
Amended by	P. L. 95-190	42 U.S.C. 300g-1(b),(e)	44-48
Water resources, Washington metropolitan area	P. L. 93-251	n.c.	145-46
Wild horses and burros, management	P. L. 95-514	16 U.S.C. 1333(b)(1),(b)(3)	153-54
	P. L. 98-473	n.c.	162-63
Wind shear, aviation hazard	P. L. 97-369	n.c.	187-88
Workplace safety. *See* Occupational safety and health			

APPENDIX 2



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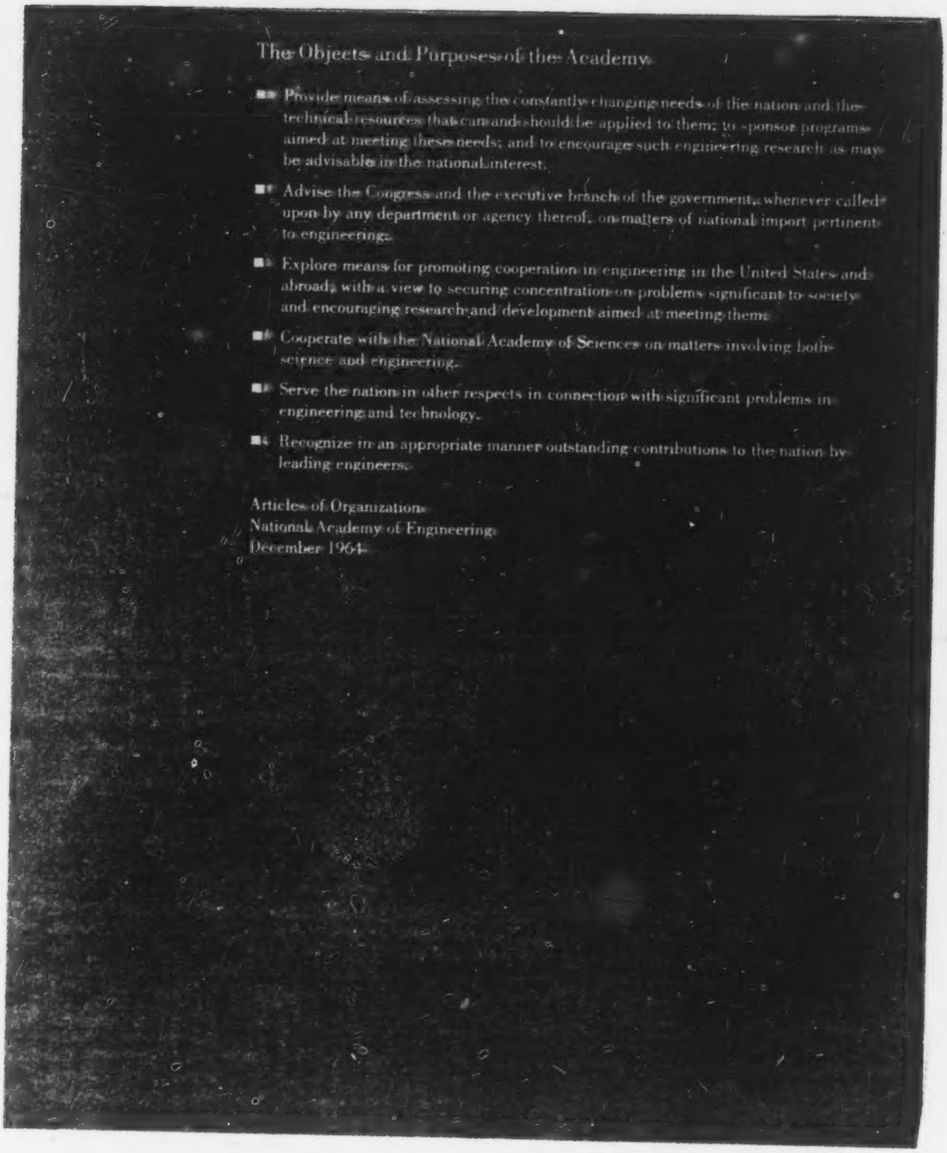

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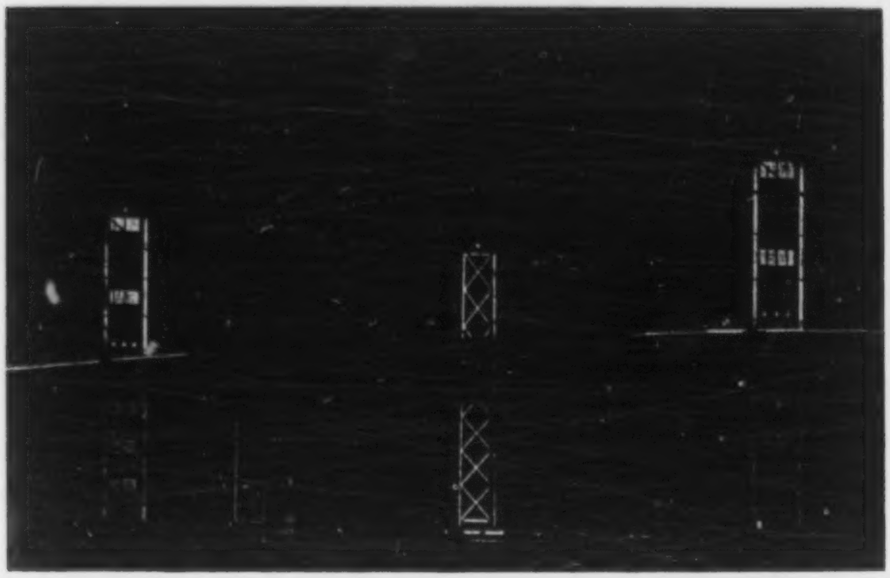
- Provide means of assessing the constantly changing needs of the nation and the technical resources that can and should be applied to them; to sponsor programs aimed at meeting these needs; and to encourage such engineering research as may be advisable in the national interest.
- Advise the Congress and the executive branch of the government, whenever called upon by any department or agency thereof, on matters of national import pertinent to engineering.
- Explore means for promoting cooperation in engineering in the United States and abroad, with a view to securing concentration on problems significant to society and encouraging research and development aimed at meeting them.
- Cooperate with the National Academy of Sciences on matters involving both science and engineering.
- Serve the nation in other respects in connection with significant problems in engineering and technology.
- Recognize in an appropriate manner outstanding contributions to the nation by leading engineers.

Articles of Organization
National Academy of Engineering
December 1964

"We are an unusual assemblage of individuals who as members of this Academy can contribute to an improved understanding of our technological world. We are in a unique position to address its problems and opportunities in a way that can be of incalculable value to our government in these times when new and often conflicting policies to cope with the impacts of technology are proposed from every podium."

Robert M. White
President
National Academy of Engineering

The National Academy of Engineering . . .



Advancing Technological Leadership

Science and engineering and the technology they spawn have long been recognized as the taproot of this nation's economic well-being. In the last 40 years, however, the steady stream of technological innovation has swelled to a torrent, changing established patterns of thought, practice, and organization. As the pace of technological change has quickened, the challenge to society has become twofold: to provide the economic and social climate that encourages needed technological development and to use the fruits of technology wisely.

The rapid movement of engineering and technology to the forefront of national policy motivated the founding of the National Academy of Engineering (NAE) in 1964. Chartered under the National Academy of Sciences (NAS), which itself was chartered in 1863 under the Administration of Abraham Lincoln, the National Academy of Engineering is a private, nonprofit institution that meets the challenge of charting technological change and fostering national technological leadership primarily by two means.

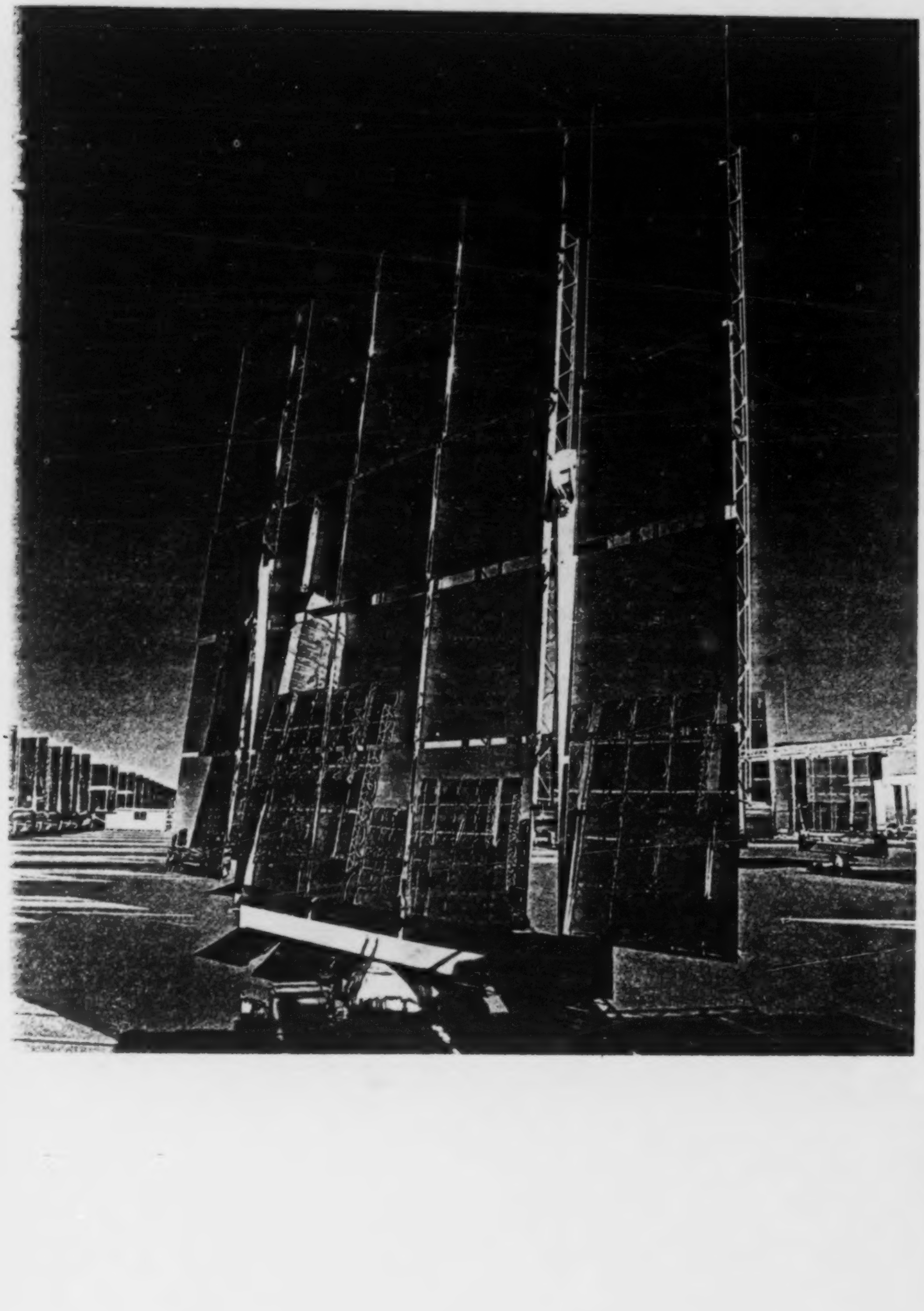
First, the Academy serves as advisor to the federal government through the National Research Council (NRC), the operating arm of the National Academy of Engineering and the National Academy of Sciences. The National Research Council draws on leading experts from across the nation for knowledge, advice, and guidance in the preparation of policy studies and assessments of technology and science.

Second, the NAE functions independently as a force for engineering and technology in national affairs through symposia, roundtables, seminars, and advisory reports which draw heavily upon its own distinguished membership.

In the conduct of these dual functions, the NAE contributes a learned, broad-based perspective to the analysis of technological issues that affect the lives of every American. Technological issues are complex, diverse, and invariably involve trade-offs. Is it possible to reduce the environmental hazards of fossil energy use yet still provide needed energy at a reasonable cost to the consumer? How can we produce and dispose of the ever-increasing catalogue of new chemicals and materials required by modern society while minimizing or eliminating environmental and health effects? Can the government support U.S. technology in the international marketplace and retain the spirit of free market competition so important to American economic growth? What will be the impacts of the microchip and computer on society and how can we make maximum use of their potential benefits?

Engineering and technology issues critical to the long-term economic and social health of the nation are of utmost concern to the National Academy of Engineering. What measures are needed to remedy the deficiencies in mathematics, science, and engineering education to provide the technologically literate workforce needed for the future? How can the imperatives of national security be reconciled with the free flow of scientific and technological ideas? What energy mix will best serve the United States, economically and environmentally? What is the proper role of nuclear power in this mix? What is required to assure that enough engineers with the proper training will be available to implement the country's technological goals? For technological issues, and for issues concerning technology in society, the National Academy of Engineering provides a unique national forum for discussion and evaluation.

The NAE contributes a broadbased perspective on the analysis of America's present and future energy needs balanced by concerns for protection of the environment.



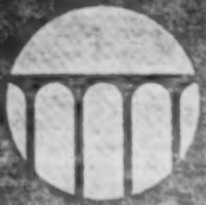
The National Academy of Engineering

Tapping the Pool of Excellence

Each autumn a small number of the nation's leaders in engineering and technology step forward to receive, in recognition of their personal achievements and contributions to engineering and technology, the medallions and blue rosettes commemorating election by their peers to the National Academy of Engineering. As they sign the Academy register, they join a truly remarkable group of individuals, over 1,300 strong including 100 foreign associates, selected from diverse institutions. Fifty-five percent of the Academy's members are from industry while forty-five percent are from universities and other institutions.

Through their contributions and leadership, these individuals are responsible for many of the vital technological achievements that have changed society. They are the designers of [illegible] navigation systems for aircraft and rockets, the builders of space vehicles, and the leaders of the revolution in microelectronics, communications, materials science and robotics. They are the originators of the information age and the designers and builders of the world's airports, dams, factories, harbors, roads, and water supply systems. No other engineering organization spans the National Academy of Engineering's breadth and diversity of talents and abilities.

As these distinguished leaders join in the work of the Academy, they become a part of the larger force of engineers, scientists, technologists, and others who contribute to national policy and program formulation on major technological issues through the National Research Council. Convened in boards, committees, and panels, they discuss, debate, and render advice on hundreds of issues of pressing concern to the government and society at large.

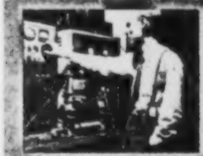


The Founders Medal was established in 1965 by the Academy to honor [illegible] [illegible] to society. The medal, a gold replica of the NAE seal, is imprinted with a stylized Roman arch representing the bridge between science and society. Recipients of the Founders Medal have been Vannevar Bush (1966), James S. McDonnell (1967), Vladimir K. Zworykin (1968), Harry Nyquist (1969), Charles S. Draper (1970), Clarence L. Johnson (1971), Edwin H. Land (1972), Warren K. Lewis (1973), J. Erik Jonsson (1974), James B. Fisk (1975), Manson Benedict (1976), John R. Pierce (1977), George M. Low (1978), [illegible] (1979), Hoyt C. Hottel (1980), Jacob P. Den Hartog (1981), Kenneth H. Olsen (1982), Harold E. Edgerton (1983), John Bardeen (1984).

George M Low

George M. Low

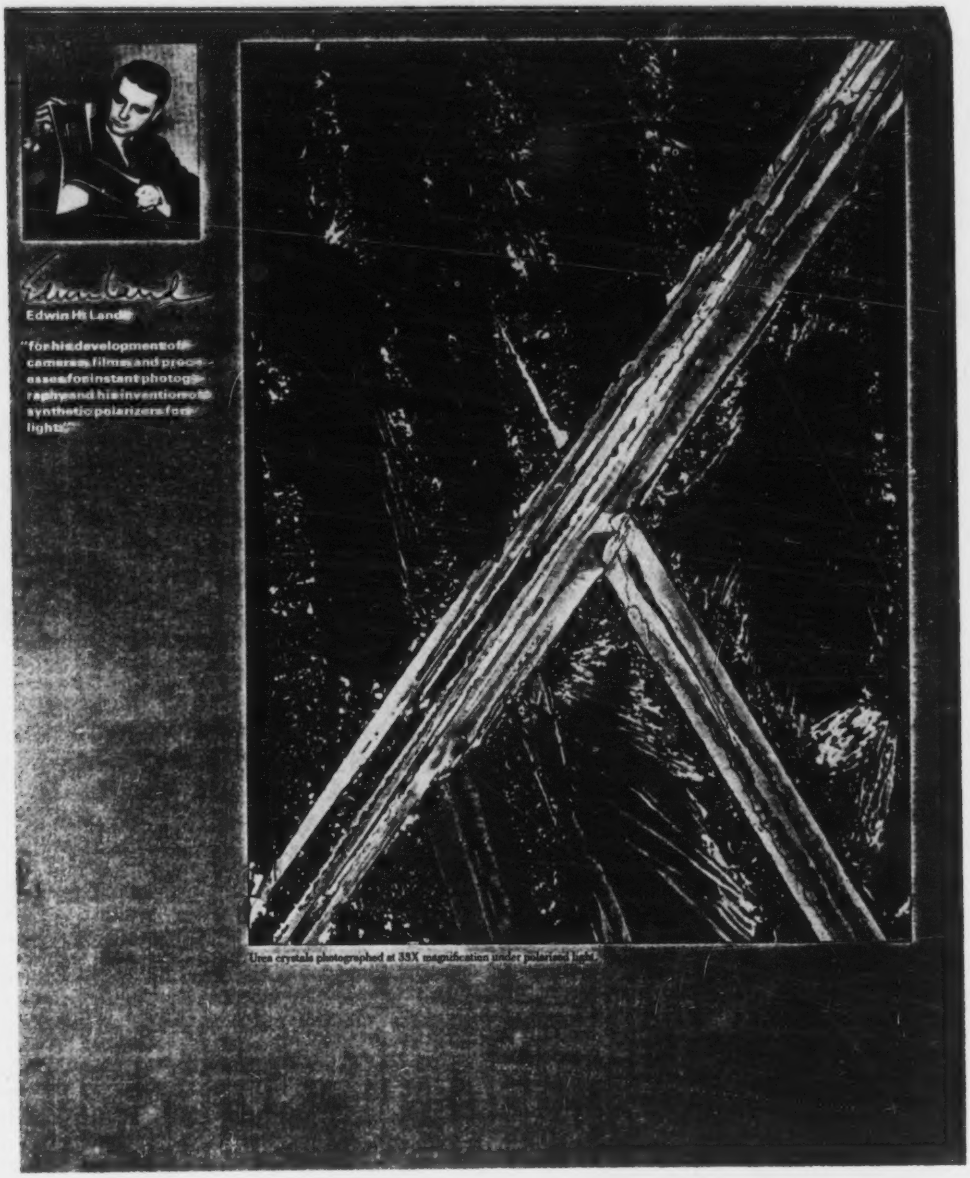
"for playing a central technical and management role in the U.S. space program and especially for his leadership in one of mankind's most complex and dramatic enterprises, which culminated in man's footsteps on the moon."



J. R. Pierce

John R. Pierce

"For his contributions to the art of electronic communications including satellites, microwave amplification and generation, and imaginative employment of digital techniques and, for his scholarship in documenting the disciplines involved and authoring treatises [illegible]



Edwin H. Land

"for his development of cameras, films and processes for instant photography and his invention of synthetic polarizers for light."

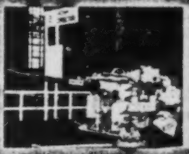
Urea crystals photographed at 33X magnification under polarized light.

Harold E. Edgerton

Harold E. Edgerton

"for his seminal achievements in ultra-high-speed photography which have captured and revealed hitherto unseen beauty and order in phenomena which range from the arts to underwater archaeological exploration, and for unselfishly giving of himself to generations of students and many different endeavors."

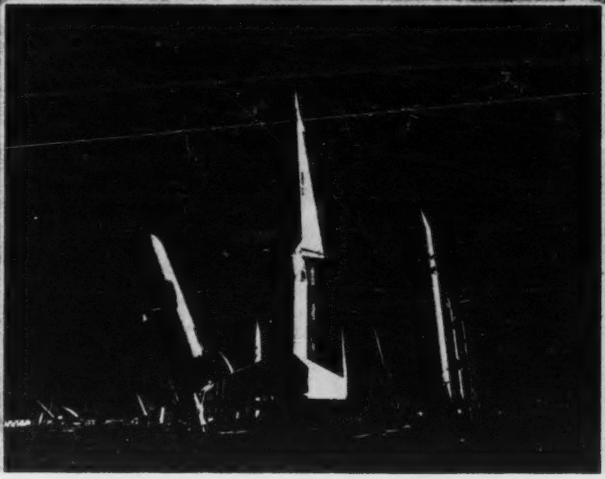
Scientists use strobe lighting to explore a mid-ocean rift in the Pacific floor.

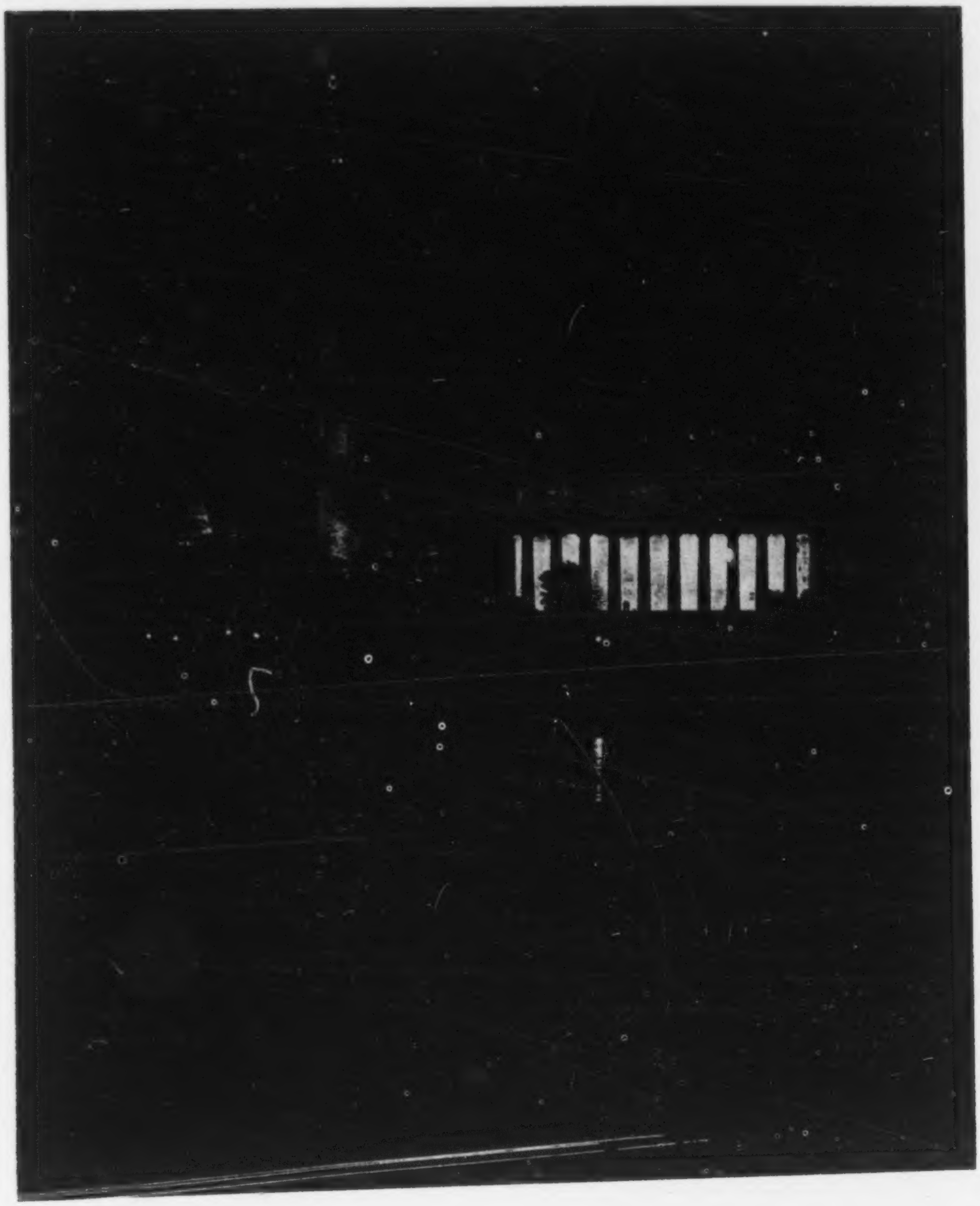


C. S. Draper

Charles S. Draper

"for his work in developing guidance and control systems for the Thor and Titan ICBMs, the Polaris submarine, and the Apollo spacecraft."





The National Academy of Engineering . . .

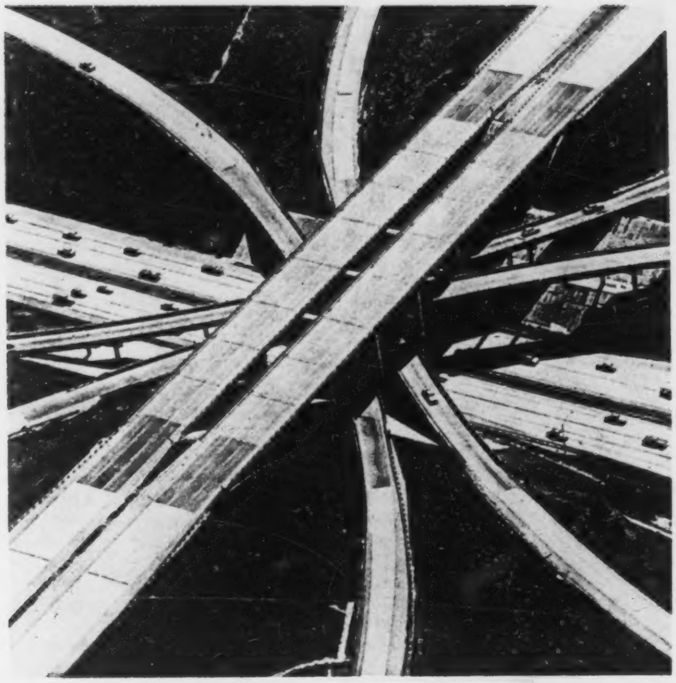
Advising the Government

The National Research Council (NRC) is the central operating organization of the National Academies of Engineering and of Sciences. Although the NAE sometimes responds directly to requests from government agencies, the NRC is the primary channel through which the NAE discharges its responsibility to advise the government. The Academies of Engineering and of Sciences, through the NRC, each year draw on the expertise of some 8,000 individuals from all fields of intellectual activity. Participation by these experts—some members of the Academies and some not—is voluntary and unpaid. The NRC, a great national resource, is directed by the Presidents of the Academies of Sciences and Engineering who serve, respectively, as Chairman and Vice Chairman of the National Research Council.

The NRC conducts about 500 studies a year, and the National Academy Press—the publishing arm of the Academies—produces and disseminates approximately 300 reports annually. Most of the work of the NRC is in response to requests from the executive agencies of the federal government as well as from the U.S. Congress. Over the years, governmental requests for advice have increased. In fiscal year 1984, government agencies spent over $80 million for studies and assessments by the National Research Council.

The breadth of the work of the NRC covers an unusual range of requests by and interests of government agencies. Study participants meet frequently to analyze and assess myriad issues related to science and technology. Their conclusions, conveyed to the federal government, often set forth detailed recommendations on programs and policies of concern not only to the government but to industry and the general public as well.

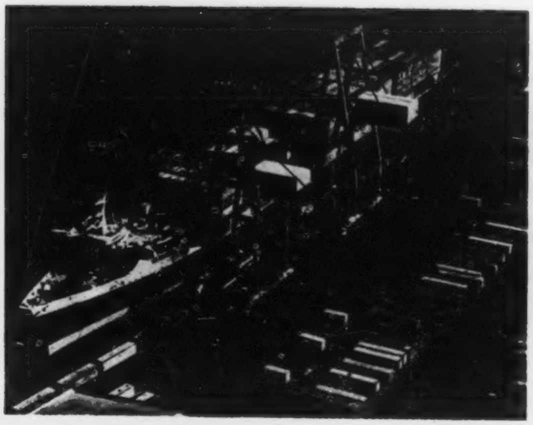
The NAE in its co-governance of the National Research Council addresses critical national issues concerning engineering and technology.

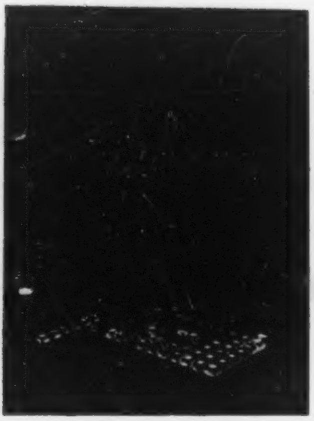


NAE and NRC studies assess and direct the growth and change of America's transportation technologies.

The work of the NRC embraces all fields of science and technology. NRC studies range from the effects of drilling discharges on the marine environment to assessments of federal programs to advance the capacities of integrated circuits. They have provided direction for the nation's aerospace programs through assessments of satellite power systems, the main engines of the space shuttle, the practical applications of space vehicles, and aircraft safety. The NRC regularly performs analyses of natural resource issues and national needs in energy and defense. Studies have included assessments of the environment needed for advanced technologies to thrive; transportation policy; domestic materials needs; and the environmental and health effects of toxic wastes and radioactive waste disposal and storage.

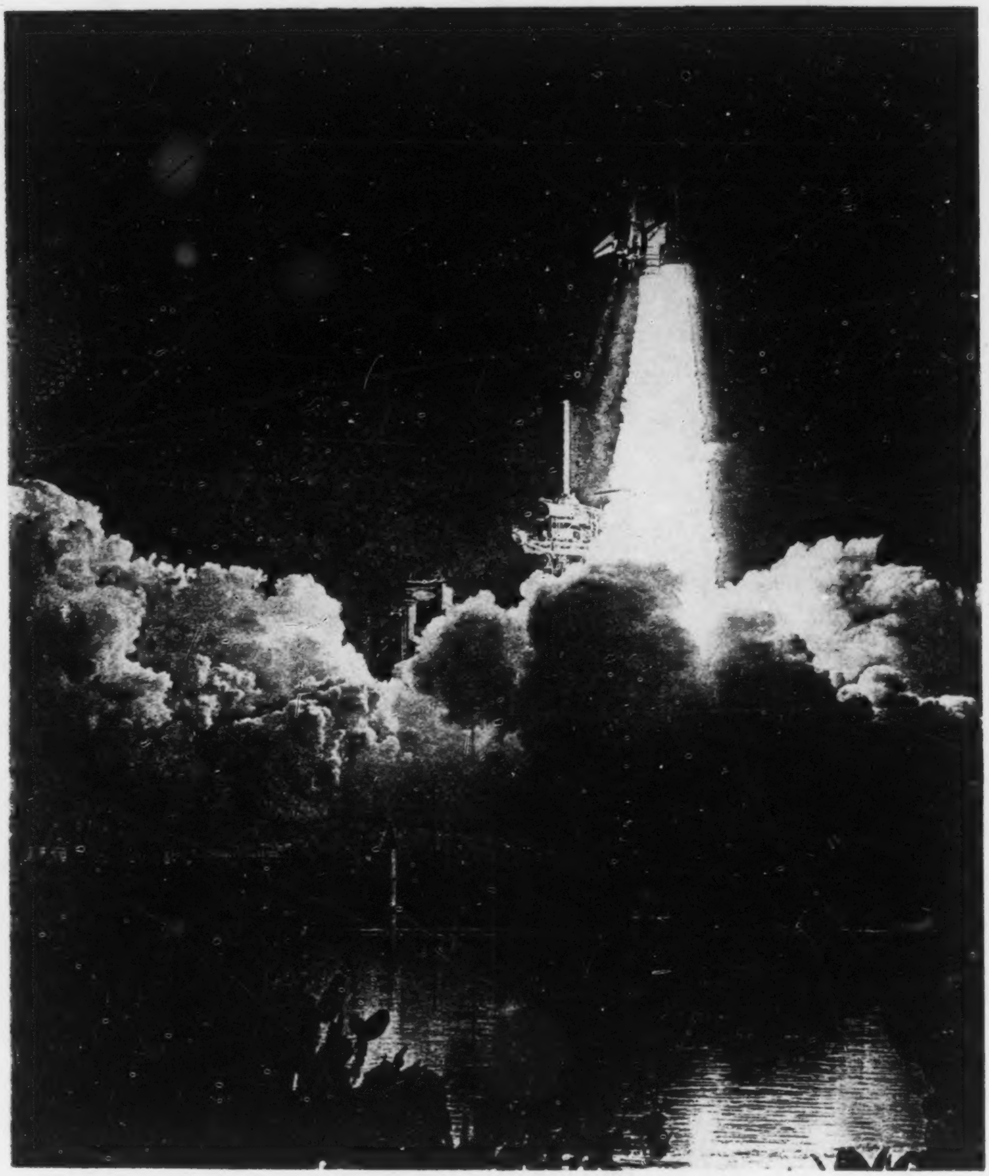
The studies requested by Congress frequently pertain to matters involving significant controversy where the Congress seeks the dispassionate, authoritative evaluation of a field's state of knowledge as a basis for legislative action. The White House Office of Science and Technology Policy also frequently requests assessments and over the past several years has asked for briefings on research priorities in various fields of science and engineering. In response to these requests, assessments have been provided in such areas as the use of computers in design and manufac-

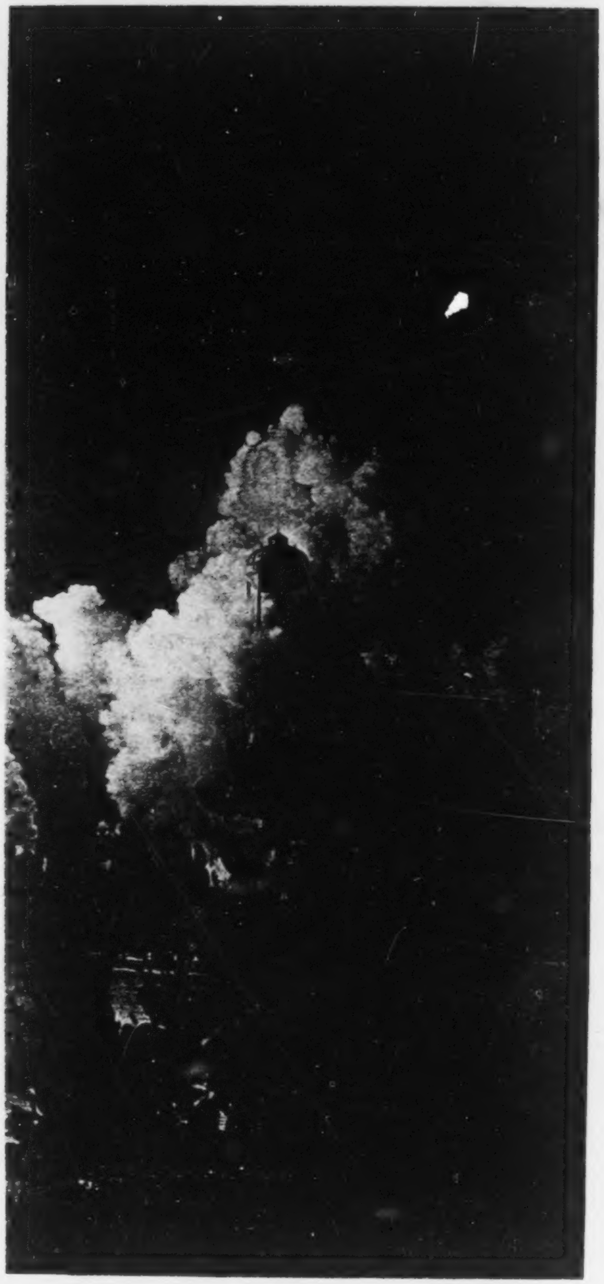




turing; selected opportunities in chemistry; cognitive science and artificial intelligence; human health effects of hazardous chemical exposures; facilities for earthquake engineering studies; and materials science.

A major strength of the Academies is the expertise and far-ranging insight of their memberships. From time to time members will bring to the Academies issues of long-range, national concern that, for various reasons, are not being addressed through the normal channels of government-initiated requests. These issues range from a concern over the possible long-term effects of acid rain to the growing problem of restrictions on the export of technology and technical information; from the problem of technological change and employment to concern about the state of scientific and engineering education. Because these issues often have long-term implications for national policy decisions, the National Academy of Engineering, together with the National Academy of Sciences, initiates work on these studies independently, using funds from private sources as well as from their own general funds. These studies, and the





national awareness they often create, are one more mechanism permitting the NAE to be an important force for technological leadership.

The studies of the Academy produced through the NRC, as well as those produced directly, frequently foreshadow changes in national policies, new programs, shifts in budgets, changes in formulation of legislation, or new technological directions for military and space programs. NRC studies have stimulated major federal research on the climatic effects of rising levels of carbon dioxide in the atmosphere, and examinations of the acid rain issue prompted new federal approaches to this difficult issue. NRC studies led to a reinvigoration of the aeronautical research program within the National Aeronautics and Space Administration, to new approaches for judging the risks and benefits of environmental regulations, and to a new look at federal policies for controlling the international flow of scientific and technological information.

Perhaps the most visible symbol of government sponsored research in partnership with private enterprise, the space shuttle missions now regularly include experimental work for the leaders of American industry.

The National Academy of Engineering . . .

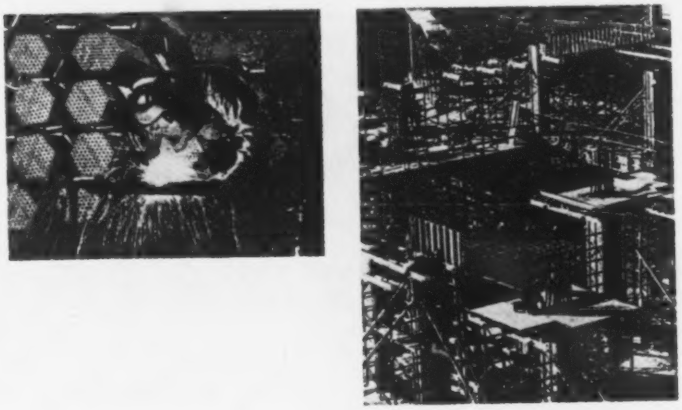
Providing a National Forum

In addition to the strong role played by the Academy in the work of the National Research Council, it also functions independently as a national forum for addressing technological and engineering issues. The NAE actively contributes to national debates by providing a channel through which its unique membership and other leading authorities address and define critical national issues where technology is an important dimension. The Academy's work is focused on critical and controversial technology-related issues in three substantive areas: the interaction of technology, the economy, and society; the character and quality of engineering education and engineering research; and the vitality of the national technological enterprise.

Technology, the Economy, and Society

An understanding of interrelationships of technology, the economy, and society is essential if public policy is to address problems rather than symptoms. Thus, the Academy recently has convened symposia to assess the long-term impact of technology on employment, to define the state of U.S. leadership in manufacturing, and to analyze the relative status of the United States in cutting edge technologies. The NAE's symposia serve two purposes. First, they often act as catalysts for more comprehensive studies conducted by the National Research Council and by the Committee on Science, Engineering, and Public Policy (COSEPUP), jointly governed by NAS, NAE, and the Institute of Medicine. For example, a comprehensive COSEPUP study of technology and its long-term impact on employment is currently under way as a result of an NAE symposium. Second, they directly raise the level of public understanding of important policy issues. NAE symposia proceedings are widely requested by individuals in government, industry, and universities.

Other symposia will address topics such as education for the manufacturing world of the future; the impact of information technology on the pace and character of social change; issues of environmental and health hazards and questions of equity; and the interaction of technology and economic structural change.



The long-term impact of technology on employment is part of an ongoing NAE symposium series on Technology and Social Priorities.

Engineering Education and Research

Although the engine of technological change and innovation lies principally in industry and the commercial sectors, its components frequently emerge from basic and engineering sciences, which are conducted principally in the universities. Engineering education and research are, in the long run, the foundation of industrial competitiveness. No technological enterprise—and every industrial economy is a technological enterprise—is stronger than the individuals that support the effort. Thus, a principal goal of the Academy is to identify and to suggest remedies for deficiencies in engineering education and research.

Recent analyses of the current state of engineering education point to serious weaknesses, and remedy will require efforts by universities, corporations, and government. Faculties must be increased to deal with the escalating enrollment of undergraduate students, equipment and facilities must be updated, and students must be encouraged to pursue advanced engineering degrees. The education of engineering students must be broadened to ensure that they appreciate and understand the complexities of the new technological world so that they can create engineering systems for communication, transportation, manufacturing, or other purposes—within economic, political, temporal, or regulatory constraints. In support of these goals, the Academy is working to strengthen the partnerships between private industry and universities.

The NAE is also working to open engineering education to minorities and women; to formulate programs to maintain the effectiveness of the national pool of engineering talent; and to encourage the proper kind of secondary education for the changing workplace. The Academy played a key catalytic role in the organization of the National Advisory Council on Minorities in Engineering, which is now an independent and vital mechanism for encouraging minorities to enter the engineering profession. Recent requests of the Office of Science and Technology Policy in The White House and of the National Science Foundation (NSF) have provided the opportunity for the Academy to advise the government on directions it can take to strengthen engineering education. Recent NAE studies on strengthening engineering

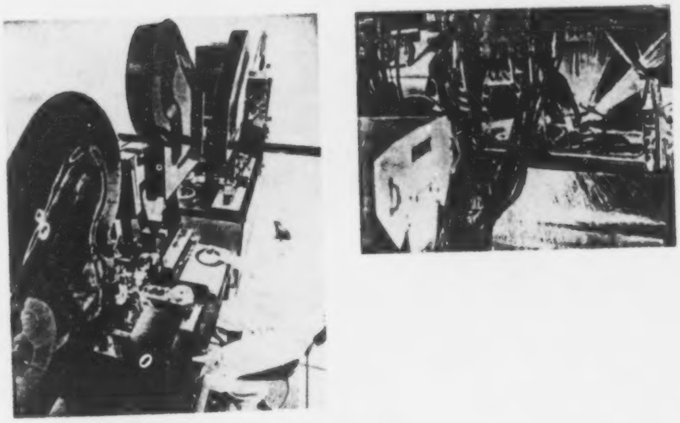
The NAE encourages equal opportunity in all areas of engineering education. Here, a student from the National Technical Institute for the Deaf at Rochester Institute of Technology works on computer-assisted drafting equipment.

in the National Science Foundation and on organizing engineering research centers at U.S. universities for cross-disciplinary engineering research of industrial importance have been widely used by the NSF in designing a new program involving the universities and industry.

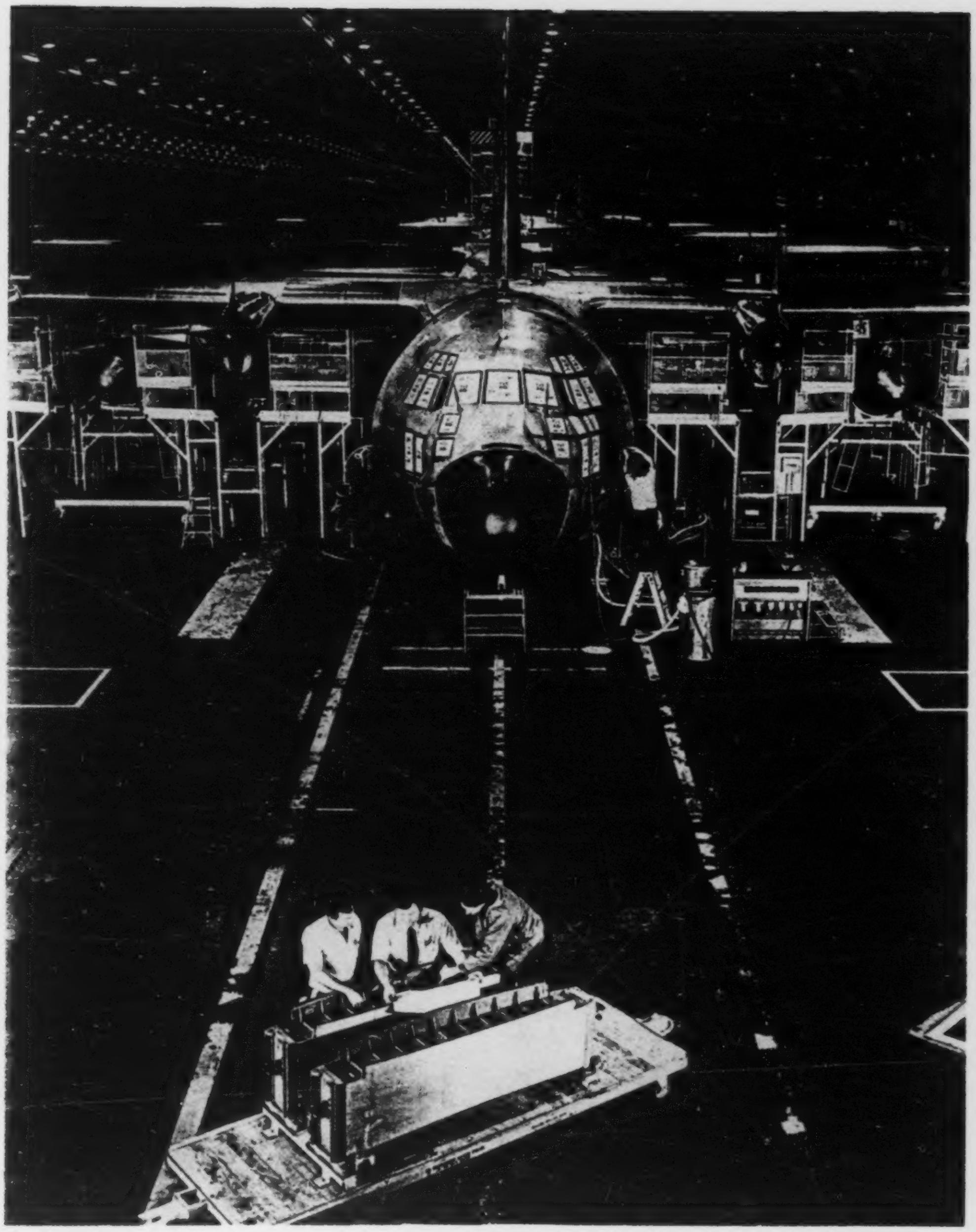
The National Technological Enterprise

The Academy concerns itself explicitly with many elements affecting the competitiveness of our industries in the global marketplace. For example, the NAE, in cooperation with the NRC, has recently issued a series of reports on the competitive status of the machine tool, textile, civil aviation, electronics, automotive, and pharmaceutical industries. Earlier NAE studies assessed the interaction of technology, trade, and the U.S. economy and the impact of federal regulation, antitrust, and tax policies on industrial innovation. These studies represent important inputs to the intense debates on the elements of a national policy in support of advanced technology.

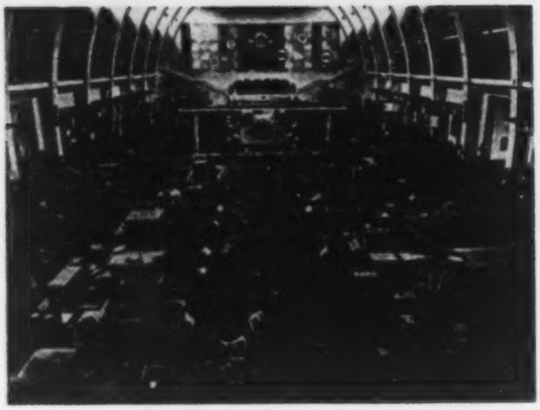
The National Academy of Engineering also provides a neutral forum for addressing many different contemporary and critical technological issues. It organizes roundtables and symposia of experts from government, industry, and universities to discuss the consequences of various courses of action. These meetings, which are often conducted in an informal atmosphere to allow for the easy exchange of viewpoints, have addressed many issues, including future requirements for synthetic fuels, the deterioration of the U.S. public works infrastructure, alternative energy systems, the impact of export controls on scientific communications, the reauthorization of U.S. clean water legislation, and the growing concern over acid rain.



The competitive status of American industry is a primary concern of the NAE, and the focus of a series of recent reports.



The NAE works to promote strong ties among engineering communities of both developed and developing countries. To the right, Carl XVI Gustaf, King of Sweden, inspects the cockpit of a Boeing jet in a recent exchange visit between the NAE and the Royal Swedish Academy of Technological Sciences. Below, a technical trade show in the People's Republic of China. The NAE and NAS have inaugurated a program of industrial and academic exchange with the PRC.



The National Academy of Engineering . . .

Operating in a Global Dimension

Many important issues confronting the United States and other nations relate to the international aspects of technology and its impact on trade and relations among nations. The marketplace has reached global dimensions, and production systems and technological development have moved in a similar direction. For these reasons, the NAE works to facilitate international understanding and collaboration in engineering and technology.

The international character of engineering and technology today requires strong ties among engineering communities from both the developed and developing countries. The Academy fostered the founding of the Convocation of Engineering Academies, a new organization established to advance international cooperation. Through this group of 14 international engineering academies, world leaders in technology meet to discuss issues of global concern.

One outcome of the international effort of the NAE is a growing number of important bilateral exchanges. Exchanges of technological delegations between Sweden and the United States have been initiated. The National Academy of Engineering has joined with the National Academy of Sciences in a bilateral program through a recent agreement with the Commission on Science and Technology of the People's Republic of China. This program will bring together, through a seminar series, applied scientists from China's production ministries and American engineers from industry and academia. Issues for discussion include fossil fuel and energy conservation technologies, agricultural and food processing technologies, and methods for transferring research findings from the laboratory to industry. With the NAS, the NAE continues to explore ways to engage the technological leaders of other nations. More broadly, the two Academies recently convened a symposium—the first of its kind—with the Council on Foreign Relations on Technology and Foreign Policy.

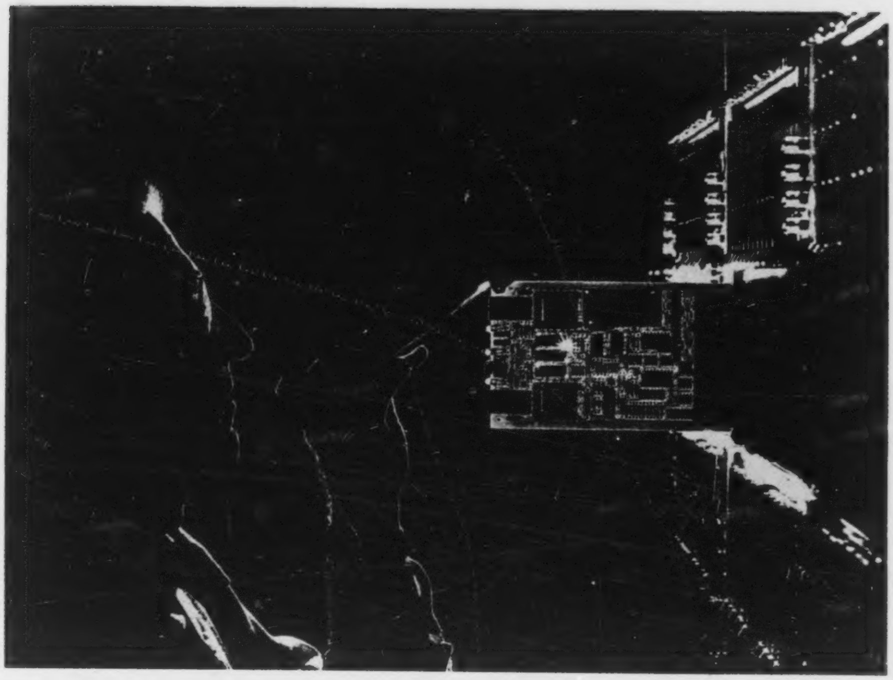
The National Academy of Engineering . . .

Looking to the Future

The National Academy of Engineering is a young institution. It celebrated the Twentieth Anniversary of its founding in 1984. In a short two decades, the National Academy of Engineering has become an important force for technological leadership in national affairs.

In a world of rapid technological changes, it is important that leaders in engineering and technology who have been in the forefront of these changes also participate in the debates about the economic, social, and political implications of their work. Also, they must be deeply involved in identifying and assessing deficiencies in and opportunities for strengthening our national technological activities. As a group, they must be concerned with economic, political, and social forces in the nation that affect the health of the technological enterprise on which the future economic welfare of this nation depends.

The National Academy of Engineering provides the channel through which the nation can benefit from the participation of those most experienced in engineering and technology. The National Academy of Engineering aspires to be of even greater service to the nation in the years ahead as it continues to gather strength from its distinguished and growing membership.



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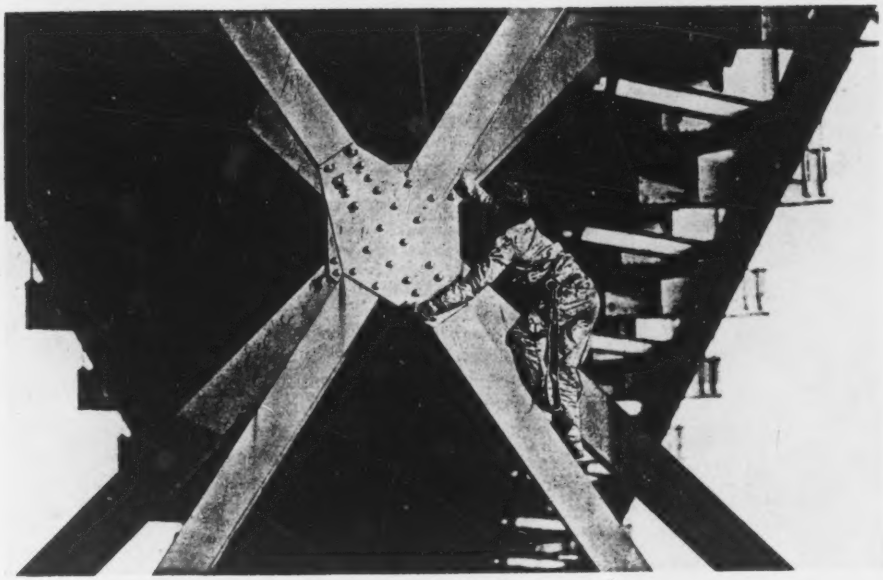


"America's economic welfare is firmly rooted in the strength of our technological leadership. Through the years, the development and quality of America's technology has been derived from the unique interactions of industry, universities, scientific organizations, and government, together creating the environment and structure that fosters initiative and development by individuals. Looking forward, the National Academy of Engineering will play a vital role as a catalyst for new thinking and new directions in the advancement of our nation's technological leadership."

Stephen D. Bechtel, Jr.
Chairman
National Academy of Engineering

National Academy of Engineering
Program Report
1 July 1984 - 30 June 1985

National Academy of Engineering
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

1986

National Academy of Engineering

The National Academy of Engineering (NAE) is a private organization established in 1964. It shares in the responsibility given the National Academy of Sciences (NAS) under a congressional charter granted in 1863 to advise the federal government on questions of science and technology. This collaboration is carried out primarily through the National Research Council. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and honors distinguished engineers.

The governing body of the Academy is its Council. It is composed of the officers and twelve other members of the Academy. Officers of the Academy include the president, chairman, vice president, home secretary, foreign secretary, and treasurer, each of whom is elected by the membership. The president of the NAS serves as an *ex officio* member of the NAE Council. In implementing the functions of the Academy, the NAE officers and Council are supported by a professional staff headed by the executive officer.

Contents

Message from the President and the Chairman 2

The National Academy of Engineering and the National Research Council 6

- Selected Engineering Activities of the National Research Council 6
- Committee on Science, Engineering, and Public Policy 8
- Government-University-Industry Research Roundtable 9
- Academy Industry Program 9

Technological Leadership Program 10

- Industrial Issues 10
- Engineering Education 12
- International Activities 13
- Status of Technology and Engineering Research 15
- Technology and Society 15
- Public Awareness 16

Other Activities 18

- Founders and Bueche Awards 18
- NAE Fellows Program 19
- Symposium Series on Technology and Social Priorities 19

Contributors to the National Academy of Engineering 20

Membership 22

Financial Report 24

NAE Officers, Council, Advisory Boards, and Staff 32

Message from the President and the Chairman

The National Academy of Engineering began its third decade in December 1984. It is appropriate at such a time that we reflect on our past with a view to evaluating where we are headed and plan how we can best meet the challenges of the years to come.

Traditionally, the Academy's greatest responsibility has been in sharing with the National Academy of Sciences and the Institute of Medicine (IOM) in the joint oversight of the National Research Council (NRC) through the NRC Governing Board. This remains the central work of our Academy. Once again this year, members of the National Academy of Engineering joined with colleagues from around the nation in the voluntary service that has been the strength of the National Research Council for almost 70 years. NRC committees produced nearly 200 reports in fiscal 1985 in such diverse areas as policy planning for national security telecommunications, ocean disposal of sewage sludge, sex segregation in the workplace, and aeronautics technology possibilities for the year 2000.

Other entities in the Academy complex have also been the focus of important activity for our Academy in the past year. The Committee on Science, Engineering, and Public Policy, a joint committee of the two Academies and the Institute of Medicine, undertook two major studies at the recommendation of the National Academy of Engineering: "The Effects of Technological Change on Employment and the Working Environment" and "The Impact of National Security Controls on International Technology Transfer." The Government-University-Industry Research Roundtable, another activity in which our Academy joins with the NAS, has begun to fulfill its role as a forum for discussion of issues affecting the nation's research enterprise and requiring the active participation of the three communities. The role of the NAE in the activities of the National Research Council has grown during the year as a result of the general strengthening of the NAE staff and the Academy's ability to enlist leading engineers and technologists in the work of the NRC.

For the National Academy of Engineering, the most important new beginning of the past year has been the formulation of an expanded program of activities for our third decade. It was shaped in large part as a response to a historic request made by President Reagan to the NAE and the NAS to assemble the nation's engineering and scientific expertise to maintain and assure U.S. technological leadership. The new effort of the Academy, accordingly designated the *Technological Leadership Program*, marks an important, evolutionary change in the life of this institution. It is envisioned as a ten-year self-sustaining program to advance the industrial competitiveness of the nation, its economic growth, and the general welfare. The plans for the Technological Leadership Program are described in separate documents. This program report covers only fiscal year 1985, ending 30 June 1985, a start-up period for the Technological Leadership efforts. In the future, this report will be issued in the fall of each year.

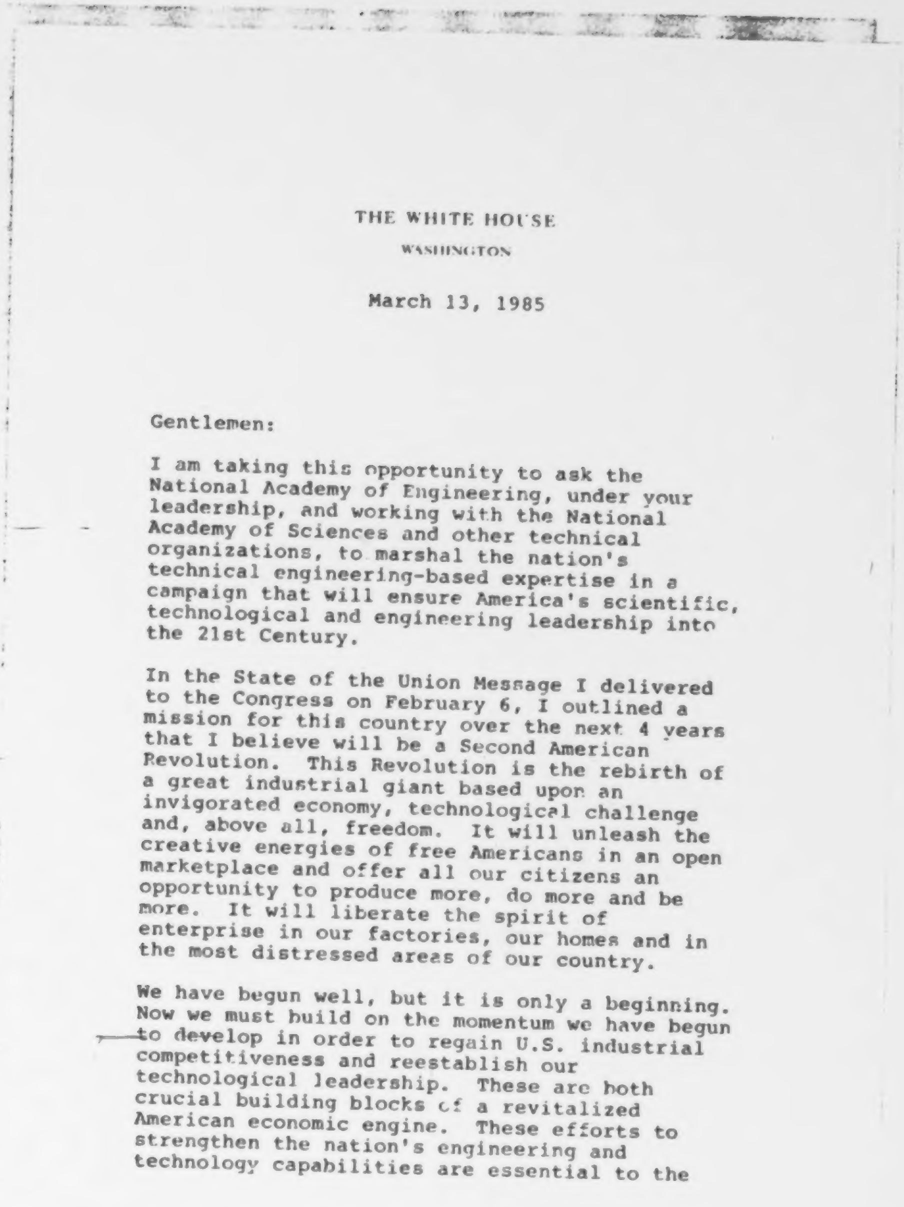
This report also recognizes contributions received by the Academy through December 1985. Accordingly, we take great pleasure in acknowledging the gift of $20 million in October from the Arnold and Mabel Beckman Foundation to the two Academies for the establishment of a West Coast center. This magnificent gift, together with The Irvine Company's associated gift of land adjacent to the University of California at Irvine, has made possible the development of plans for the Arnold and Mabel Beckman Center of the National Academies of Sciences and Engineering, now scheduled for completion in the fall of 1987.

Robert M. White, President
Stephen D. Bechtel, Jr., Chairman

January 1986

Robert M. White

Stephen D. Bechtel, Jr.



THE WHITE HOUSE
WASHINGTON

March 13, 1985

Gentlemen:

I am taking this opportunity to ask the National Academy of Engineering, under your leadership, and working with the National Academy of Sciences and other technical organizations, to marshal the nation's technical engineering-based expertise in a campaign that will ensure America's scientific, technological and engineering leadership into the 21st Century.

In the State of the Union Message I delivered to the Congress on February 6, I outlined a mission for this country over the next 4 years that I believe will be a Second American Revolution. This Revolution is the rebirth of a great industrial giant based upon an invigorated economy, technological challenge and, above all, freedom. It will unleash the creative energies of free Americans in an open marketplace and offer all our citizens an opportunity to produce more, do more and be more. It will liberate the spirit of enterprise in our factories, our homes and in the most distressed areas of our country.

We have begun well, but it is only a beginning. Now we must build on the momentum we have begun to develop in order to regain U.S. industrial competitiveness and reestablish our technological leadership. These are both crucial building blocks of a revitalized American economic engine. These efforts to strengthen the nation's engineering and technology capabilities are essential to the goal of helping American businesses and workers to modernize and compete. We must also press forward in the use of our engineering and technological strengths to provide for the health and safety of the working and natural environment.

Two conditions are of utmost importance to these efforts: first, we must engage the best minds and experience the country has to offer; and second, the private sector must take the lead. Your Decade Three Program will address the broad spectrum of issues essential to U.S. industrial competitiveness and technological leadership. This Program will be supported primarily by private sector funds. With the issuance of the Report of the President's Commission on Industrial Competitiveness, the Academy program will be especially timely in dealing with engineering and technology needs that undergird the country's economic vitality.

Your program is robust, and appropriate to the challenge. I know American industry and other private organizations are supporting your initiatives. I heartily endorse your efforts. They are vital to the goal of maintaining a strong America with a bright future.

I urge the Academy to carry out these initiatives. With your help, and our national ingenuity, I am confident the Second American Revolution will bring new progress and success.

Sincerely,

Ronald Reagan

Mr. Stephen D. Bechtel, Jr., Chairman
Mr. Robert M. White, President
National Academy of Engineering
Washington, D.C. 20418

The National Academy of Engineering and the National Research Council

The National Research Council (NRC) is the operating arm of the National Academy of Engineering and the National Academy of Sciences. It operates through some 800 committees in which nearly 8,000 scientists, engineers, and other professionals contribute their advice and experience to the solution of national problems. In fiscal 1985, more than 350 members, approximately 30 percent of the membership, of the National Academy of Engineering participated in studies of the NRC. NRC studies are typically undertaken at the request of, and with financial support from, federal agencies. Some activities of the NRC are supported by funds from corporations, private foundations, and the general funds of the Academies. Not part of the NRC, but administered jointly by the two Academies and the IOM, are the Committee on Science, Engineering, and Public Policy (COSEPUP) and the Government-University-Industry Research (GUIR) Roundtable, whose activities are reported here and appropriately identified.

Participation in the work of the NRC not only by members of the NAE but by the entire engineering community enables engineers from U.S. industry, universities, and other organizations to contribute voluntarily to the work of advising the federal government on national problems involving engineering and technology. NRC committees advise on policies and programs in such fields as transportation, aeronautics and space, materials, electronics, telecommunications, building and construction, hazards mitigation, energy, manufacturing, environmental systems, natural resources, chemical engineering, and water resources. The total expenditures of the NRC, COSEPUP, and GUIR Roundtable in fiscal 1985 were $85 million. This report describes only a few of the many highlights of the activities of these groups.

Selected Engineering Activities of the National Research Council

The subjects of National Research Council studies range from the cosmic to the routine, involve both domestic and international problems, and vary from assistance on major policy and regulatory issues to assistance on narrow topics of engineering and science. Perhaps a majority of these studies have major engineering content. Thus, many national technological and policy issues involving engineering are addressed not only in the Commission on Engineering and Technical Systems but also in many of the other commissions and boards of the NRC.

The following NRC studies relating to engineering in the large, undertaken in cooperation with the National Academy of Engineering, were completed or under way in fiscal 1985.

Strengthening Engineering Education and Practice. Public and private demand for engineering goods and services will increase as society becomes more dependent on the high technology industries of the future, but will engineers be prepared to meet this challenge? The NRC Committee on the Education and Utilization of the Engineer, chaired by Jerrier A. Haddad (NAE), is addressing a wide range of issues affecting the education and employment of engineers. A series of nine reports bearing on engineering education and the role of engineering in modern economic life will be published and actively disseminated. The first two in the series were published in fiscal 1985: *Engineering Education and Practice in the United States: Foundations of Our Techno-Economic Future*, and *Engineering Employment Characteristics*.

> *A shortage of highly qualified faculty continues to threaten the quality of engineering education. Universities must take steps to make engineering faculty careers more attractive than at present in order to fill vacant faculty positions. Salaries need further improvement, adequate facilities are necessary, and current teaching overloads should be reduced. Such measures would help to alleviate the problem by increasing the number of highly qualified U.S. citizens who obtain the Ph.D. and choose teaching as a career.*
>
> Committee on the Education and Utilisation of the Engineer,
> Jerrier A. Haddad, IBM, retired, chairman

Engineering Research Priorities. The Engineering Research Board was established in 1984 in the NRC Commission on Engineering and Technical Systems to assess priorities in engineering research. The Board has organized an 18-month overview study of engineering research in the United States to determine its scope and character and its contributions to national priorities in the context of increased productivity and improved international competitiveness. Engineering research opportunities and needs are being identified and highlighted in order of priority, with special consideration given to research areas where increased federal support would be most effective. The study will also address solutions to problems in the overall management of engineering research from a national point of view. The study is being carried out by examination of seven cross-disciplinary areas: transportation; bioengineering; construction and structural design; materials; information, communications, computation and control; manufacturing; and energy, resources, and environment. Chairman: Allen E. Puckett (NAE), Chairman and Chief Executive Officer, Hughes Aircraft Company.

Assessing the Engineering Labor Market. In light of current forecasts of employment growth in engineering, the National Academy of Engineering and the NRC Office of Scientific and Engineering Personnel cosponsored a symposium to examine the potential for shortages of engineers in certain areas. Panels looked especially at the potential for severe shortages on engineering faculties and in federal laboratories. The proceedings of the symposium have been published in *Labor-Market Conditions for Engineers: Is There a Shortage?*

Committee on Science, Engineering, and Public Policy

The Committee on Science, Engineering, and Public Policy (COSEPUP) was organized in 1981 as a joint committee of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Its responsibilities include concern for issues that broadly affect the scientific and technical communities and the national interest. Principal core support for COSEPUP is provided by the National Science Foundation. The following projects were completed or under way in fiscal 1985.

The Effects of Technological Change on Employment and the Working Environment. This study, undertaken at the suggestion of the Council of the National Academy of Engineering, focuses on the effect of new workplace technologies on job creation and displacement, wages, occupational safety and health, employment-related training and education, labor-management relations, and issues of public policy. Chairman: Richard Cyert, President, Carnegie-Mellon University.

Annual Research Briefings. *Research Briefings 1985* was the fourth set of annual research briefings prepared especially for the Office of Science and Technology Policy (OSTP), the National Science Foundation, and other interested federal departments and agencies. The purpose of the briefings is to identify areas of research likely to return the highest scientific dividends if provided additional federal support in the upcoming fiscal year. The 1985 briefing topics were computer vision and pattern recognition; ceramics and ceramic composites; biotechnology in agriculture; remote sensing of the earth; weather prediction technologies; pain and pain management; and scientific frontiers and the Superconducting Super Collider. *Research Briefings 1985* forms the basis for one chapter in the 1985 Annual Science and Technology Report, submitted by OSTP to the Congress.

The Impact of National Security Controls on International Technology Transfer. This study addresses the problems that have arisen in attempting to balance national security concerns with concerns about the ability of U.S. industry to compete in international markets. Chairman: Lew Allen, Jr. (NAE), Director, Jet Propulsion Laboratory.

Government-University-Industry Research Roundtable

Organized in 1984 as a joint activity of the two Academies and the Institute of Medicine, the Government-University-Industry Research Roundtable provides a forum where scientists, engineers, administrators, and policymakers from government, universities, and industry can come together on an ongoing basis to explore ways to improve the productivity of the nation's research enterprise. The Roundtable's object is to try to understand issues, to inject imaginative thought into the system, and to provide a setting for the seeking of common ground; it does not make recommendations nor offer specific advice, but develops options and brings all interested parties together. Initial activities included testimony on "The Federal Government and the University Research Infrastructure" before the House Science and Technology Committee Task Force on Science Policy and a public hearing on "Reducing Bureaucratic Accretion in Government and University Procedures for Sponsored Research." Chairman: Dale R. Corson (NAE), President Emeritus, Cornell University.

Academy Industry Program

Now in its third year, the Academy Industry Program was established by the two Academies in recognition of the major role of industry in American science and technology. It is a mechanism for ensuring a continuing involvement of U.S. industry in the work of the National Research Council. One important function is the organization of symposia and other events. In fiscal 1985 these programs included "Biotechnology: Creating an Environment for Technological Growth," a conference held in February 1985 to consider the techniques, safety, regulation, and ethics of genetic engineering; and in March 1985, a seminar on "Science, Technology, and the National Agenda," at which Secretary of State George P. Shultz spoke on science in relation to American foreign policy.

Technological Leadership Program

The Technological Leadership Program of the National Academy of Engineering comprises a set of self-initiated activities aimed at strengthening the nation's engineering and technological capabilities. These activities encompass and expand the traditional concerns of the Academy and complement the Academy's participation in oversight of the National Research Council. The Program is planned as a ten-year undertaking. It consists of work in six areas: Industrial Issues, Engineering Education, International Activities, Status of Technology and Engineering Research, Technology and Society, and Public Awareness. These divisions constitute the administrative structure within which the following activities are carried out as parts of a coherent program.

> *[I]ndustry is not alone in being affected by [global] competition. The security of American jobs, the standard of living of our people, indeed the power and influence of our country are also at peril--because a country with industries that are not competitive is a country which cannot guarantee employment for its people or secure its own leadership role in the world of nations.*
>
> Roger B. Smith, Chairman and Chief Executive Officer, General Motors Corp.

Industrial Issues

The Industrial Issues Program addresses technology and trade, technological innovation, and related problems of energy, environment, and employment. The program focuses on matters of public policy bearing on technological development and innovation as means by which U.S. industries can remain efficient and competitive.

U.S. Industrial Competitiveness. Publication of *The Competitive Status of U.S. Industry--An Overview* in 1985 brought to a close a study begun in 1982 by the NAE Committee on Technology and International Economic and Trade Issues. In cooperation with the National Research Council, the Committee studied the influences of technology in determining international industrial competitive advantages in selected industries. Study panels assessed the competitive status of seven U.S. industrial sectors--automobiles, electronics, steel, machine tools, pharmaceuticals, civil aviation manufacturing, and fibers, textiles, and apparel. The last two reports in the series were published in 1985: *The Competitive Status of the U.S. Steel Industry*, and *The Competitive Status of the U.S. Civil Aviation Manufacturing Industry*.

A symposium on "U.S. Industrial Competitiveness and the National Academy of Engineering" was convened on 14 May 1985 to respond to President Reagan's request that the Academies "marshal the nation's technical engineering-based expertise in a campaign that will ensure America's scientific, technological and engineering leadership into the 21st Century" (see pp. 4-5); to announce publication of the overview report in the competitivness series; and to introduce the Academy's Technological Leadership Program. Symposium participants included some of the nation's industrial and academic technological leaders, who discussed the nature of the current challenge to U.S. industrial competitiveness and how the Academy might strengthen its programs to respond to President Reagan's charge. The brief report *U.S. Industrial Competitiveness and the National Academy of Engineering* is based on symposium presentations.

> *That [managing our industries on a world scale] has not yet been achieved is apparent in a number of ways: the low level of proficiency in foreign languages and limited knowledge of foreign cultures provided by our educational system; government policies that reflect concern only with domestic issues, with little regard for their effect on our international competitiveness; the recurring hostility between government and industry on market matters and the bureaucratic tangles that ensnarl licensing, certification, and approvals; the control of technology transfer in ways that are inconsistent and lack perspective on the availability to foreign customers of alternate sources; the comparatively low emphasis put on international experience in U.S. executive development programs; and, the comparative disadvantage of U.S. firms with respect to public financial and tax supports for foreign trade, and for the capital investments needed to keep us competitive.*
>
> N. Bruce Hannay, Retired Vice President-Research and Patents, Bell Laboratories

Economics and Technology. The NAE "Symposium on Economics and Technology" was held on 13-14 March 1985 at Stanford University in cooperation with the Center for Economic Policy Research and the Departments of Chemistry and Chemical Engineering at Stanford. The symposium was organized to deepen the understanding of engineers and economists about the determinants of successful technological innovation. A tabloid summary of selected presentations was published as an experiment in dissemination of information. Proceedings of the symposium were edited for publication in *The Positive Sum Strategy: Harnessing Technology for Economic Growth* early in 1986. Cochairmen: Ralph Landau (NAE), vice president of the National Academy of Engineering, and Nathan Rosenberg, professor and chairman of the Department of Economics, Stanford University.

> *Harnessing technology for growth, however difficult, is essential for success, of a company and a nation, particularly in a sustained period of low growth. . . . A low growth era requires that products, and processes to make them, have 'edge.' Both product and process edge flow from technology.*
>
> **Robert Malpas, Managing Director, British Petroleum Co. PLC**

Engineering Education

The Engineering Education Program is designed to define and examine specific problems of engineering education and to contribute to the public policymaking process leading to their resolution.

Education for the Manufacturing World of the Future. Essential to the successful introduction and operation of new manufacturing technologies in U.S. factories is a well-educated, well-trained force of engineers and other professionals to plan, manage, and operate these manufacturing systems. Yet, the needed courses for students and working professionals are not available in many cases, and industry has not well articulated its future requirements for manufacturing personnel. How to structure the educational process to meet national objectives for the manufacturing sector is a difficult and important issue. In September 1984, a symposium proposed by Erich Bloch (NAE), then vice president of IBM Corporation, and chaired by Robert A. Frosch (NAE), vice president of General Motors Corporation, brought together educators and industrialists to seek answers to this question. A symposium report, *Education for the Manufacturing World of the Future*, was published in 1985.

> *[T]he art and science of manufacturing engineering have been allowed to decay, and companies have not recognized manufacturing engineering skills as high-priority ones to be highly rewarded. . . . [M]anufacturing has increasingly become a place to demonstrate only "managerial" skills, with more rewards given for these than for . . . competence, skill, and ingenuity in the technical tasks of manufacturing.*
>
> **Robert A. Frosch, Vice President, General Motors Corp., and cochairman of Symposium on Education for the Manufacturing World of the Future**

The New Engineering Research Centers. In response to a request from the National Science Foundation (NSF), a National Academy of Engineering committee headed by W. Dale Compton (NAE), vice president-research, Ford Motor Company, formulated guidelines for the mission, organization, operation, and funding of the university-based, cross-disciplinary Engineering Research Centers (ERCs) established by NSF. These centers were conceived as an innovative approach to underpin the nation's industrial competitiveness through a partnership of universities, industry, and government. Their principal focus is on areas of importance to U.S. industry, such as manufacturing, robotics, and biotechnology. The first six Centers were announced in April 1985. *The New Engineering Research Centers: Purposes, Goals, and Expectations* contains papers presented at a National Research Council symposium later that month to introduce the new Centers to the engineering community at large.

> *The research at the Centers should be fundamental research in the areas of engineering practice being taken on by industry--that is to say, its aim is not building robots for factories, but generating new understanding of the fundamentals of robotic vision, touch, and control; not programming expert systems for use in diagnostics or repair, but generating new understanding of knowledge representation, search and logic programming techniques, heuristics, analogies, causality, and the other fundamentals of artificial intelligence; not building biotechnology production facilities, but developing unit operations concepts for biological processes. . . . The main point is not to drive universities away from fundamental research, but to orient them toward the areas of fundamental research that are most needed by industry.*
>
> **Roland W. Schmitt, Senior Vice President for Corporate Research and Development, General Electric Co.**

International Activities

The International Activities Program is designed to probe the many new issues arising from a global economy in which technology is the basis for both cooperative and competitive endeavors. The program seeks to strengthen the international community of engineering and technology institutions, promote interaction between the technological leaders and communities of various nations, and foster productive dialogue on technological issues in the international marketplace.

International Engineering in the National Science Foundation. In August 1984 the National Science Board sought the assistance and advice of the NAE in defining international issues in engineering. An ad hoc NAE group led by Foreign Secretary H. Guyford Stever identified four main questions for the NSF: Are we adequately informed of areas of excellence in engineering abroad? Do we have a healthy set of mechanisms for connecting to engineering progress abroad? Do international data and information collection and networking for engineering operate effectively for the U.S. in both directions? And, can we have an improved set of major collaborative efforts in engineering research? The letter report *International Engineering in the National Science Foundation--Issues and Ideas* was published in November 1984. Subsequent discussions with the NSF have led to the establishment of a full-scale NAE study on international cooperation in engineering, to be completed in 1987.

It may be desirable for the NSF . . . to improve our ability to identify areas of excellence in engineering research and achievement abroad, especially in areas that are not subject to export controls. . . . We can do a better job for the U.S. of encouraging inflow from foreign sources and showcasing here the best in foreign engineering.

H. Guyford Stever, Foreign Secretary, National Academy of Engineering

International Nuclear Materials Safeguards. At the request of T. Keith Glennan and other NAE members, the Academy convened an international roundtable discussion in April 1985 to discuss the possibilities for and the means of improving the effectiveness and credibility of safeguards on nuclear materials as administered by the International Atomic Energy Agency (IAEA). The group, chaired by former U.S. ambassador to the IAEA Gerald F. Tape, concluded that there is a vital need for continuing effort by a private international group whose objectives would be to strengthen safeguards and other elements of the nonproliferation regime, and urged the NAE to take the lead in establishing such a group. The NAE is now actively seeking to establish an international, nongovernmental forum in this area.

International Convocation of Engineering Academies. "The Global Interaction of Technology" was the theme of the Fifth Convocation of the Council of Academies of Engineering and Technological Sciences, held in London in June 1985. NAE Foreign Secretary H. Guyford Stever chaired the U.S. session, which included presentations on manufacturing technologies, advanced manufacturing systems, and artificial intelligence technologies in CAD/CAM and Computer Integrated Manufacturing. Sessions in other technologies were organized by the Academia Nacional de Ingenieria de Mexico, the Australian Academy of Technological Sciences, the Fellowship of Engineering of the United Kingdom, and the Royal Swedish Academy of Engineering Sciences. The National Academy of Engineering will host the Sixth Convocation in Washington, D.C., in April 1987.

Technological Frontiers and Foreign Relations. In cooperation with the Council on Foreign Relations, the Academies published a volume from a May 1984 symposium that examined such topics as effects of science and technology on East-West and North-South relations.

Science, Technology, and Economic Development Program with China. In fiscal 1985, the two Academies initiated a program of workshops with the People's Republic of China with meetings on technologies for reduction of postharvest food loss and for clean fuel from coal.

Status of Technology and Engineering Research

The Status of Technology and Engineering Research Program provides current assessments of new technologies and those with potential beyond their current uses. A second area of activity is examination of the institutional basis for support of U.S. research and development.

New Directions for Engineering in the National Science Foundation. In response to a request from the National Science Foundation in December 1984, the National Academy of Engineering organized a committee to review programs in the NSF Directorate for Engineering. In particular, the Academy was asked for advice on future challenges and national needs, opportunities for the various fields of engineering, strengths and weaknesses of NSF engineering programs, new NSF initiatives relating to critical and emerging technologies, and long-term resource requirements. The Committee to Evaluate the Programs of the National Science Foundation Directorate for Engineering was chaired by Peter W. Likins (NAE), president of Lehigh University. The committee's report, *New Directions for Engineering in the National Science Foundation*, was published in April 1985.

> *Because of the technological advances of recent years, engineering schools now need equipment in areas where they have done very little research in the past. . . . This is true, for example, in robotics and process engineering, not to mention facilities for such activities as ultraclean microelectronics fabrication.*
>
> NAE Committee to Evaluate the Programs of the National Science Foundation Directorate for Engineering, Peter W. Likins, President, Lehigh University, chairman

Cutting Edge Technologies. The technical session of the Nineteenth NAE Annual Meeting consisted of presentations by experts in computers, biotechnology, structural materials, and transportation. Participants discussed technological advances in those fields, their current and projected applications, and the obstacles that must be overcome to ensure future progress. The proceedings of that session, *Cutting Edge Technologies*, were published by the National Academy Press in October 1984.

Technology and Society

The Technology and Society Program addresses the need to improve understanding of individual, social, and institutional adaptation to technological change. An important aspect of this program's activities is the thoughtful examination of the purposes and forms of social intervention in the development and deployment of technology.

Information Technologies and Social Transformation. Information technologies are perhaps the most aggressive technologies of the current age, generating progress, change, and turbulence in many branches of industry and in the lives of organizations and individuals. Microelectronic systems are shrinking in size and cost, growing in performance, expanding their range to the world level, and crossing cultural boundaries. As societies attain higher orders of information handling, existing social institutions are faced with the dual challenge of both directing and accommodating social change driven by technology. A report of a symposium held in October 1984 to address these issues, *Information Technologies and Social Transformation*, was published in 1985.

> *It is interesting to note that though the telephone network is the world's most complex computing system, the power of that vast network is available even to a child with virtually no training.*
>
> **John S. Mayo, Executive Vice President, Network Systems, AT&T Bell Laboratories**

Hazards: Technology and Fairness. A symposium on "Hazards: Technology and Fairness," held on 3-4 June 1985, brought together members of academic, industrial, legal, and public-sector communities with expertise in the management of technological hazards. They considered issues related both to exposure to chronic, low-level hazards, where cause and effect are at issue, and to high-consequence hazards assessed as having a low probability of occurrence. Focus was on equitable distribution of benefits and costs of potentially hazardous technologies, and management of hazards in the face of conflicting scientific, ethical, and political claims. A report of the symposium will be published in 1986.

> *Can one design reactors or waste canisters for which the probability of [serious accidents] is zero--or at least, where the prevention of such mishaps relies on immutable laws of nature that can never fail rather than on the less reliable intervention of electromechanical devices?*
>
> **Alvin Weinberg, Distinguished Fellow, Institute for Energy Analysis, Oak Ridge Associated Universities**

Public Awareness

An important activity of the National Academy of Engineering Technological Leadership Program is the building of public awareness of the role of engineering and technology in the history and the daily life of the nation. To this end the Academy began to develop a Public Awareness Program designed to improve understanding of the importance of engineering and technology to the nation's welfare and to foster the collective action of the engineering community in raising public appreciation of engineering and technology.

Issues in Science and Technology. In cooperation with the National Academy of Sciences and the Institute of Medicine, the NAE launched a quarterly publication, *Issues in Science and Technology*, to provide an international forum for informed discussion of science, technology and health policy issues. *Issues* is an independent journal of opinion, intended to enhance the quality of debate on policy issues in which science and technology play a critical role. *Issues* premiered in the fall of 1984.

Meeting with Professional Societies. A look at issues affecting engineering and the national interest was the focus of the 1985 Convocation of Professional Engineering Societies held at the National Academy of Engineering on 6 May 1985. Representatives of 23 professional engineering societies participated in panel discussions on the following topics: public awareness, engineering education, technology policy, and competitiveness.

Establishing an NAE Office of Public Awareness. An integral part of the Technological Leadership Program in fiscal 1985 was planning for an NAE Office of Public Awareness to improve public understanding of engineering and technology. Proposed elements of the plan include development of an engineering achievement awards program, publications on contemporary issues, increased public affairs activities, and continuing communication with government and industry leaders.

To obtain a copy of any publication mentioned in this report, write or call:

Office of Administration and Finance
National Academy of Engineering
2101 Constitution Avenue, N.W.
Washington, D.C. 20418
Phone: 202/334-2195

Other Activities

Founders and Bueche Awards

The National Academy of Engineering selected two prominent engineers as the 1984 recipients of the NAE Founders Award and the Arthur M. Bueche Award. Both awards were presented at the NAE Annual Meeting in October.

John Bardeen, professor emeritus of physics and electrical engineering at the University of Illinois at Urbana-Champaign, received the 1984 Founders Award in recognition of his remarkable creativity in engineering, science, and invention. His discovery of the transistor, his theory of superconductivity, and his role in the development of xerography have had a profound influence on engineering theory and practice and have permanently transformed the modern world.

Edward E. David, Jr., then president of Exxon Research and Engineering Company, was selected as the second recipient of the Academy's Bueche Award. He was recognized for his seminal influence on engineering and science policy and his outstanding accomplishments stemming from his varied roles as advisor to Presidents, leader of industrial research, upholder of engineering education, participant in industry-government-university relationships, and catalyst for international collaboration in science and technology.

NAE Fellows Program

The NAE Fellows Program provides opportunities for young engineers and other specialists, including political scientists and economists, to associate with leaders in industrial technology and engineering research and with federal officials through participation in the NAE Technological Leadership and other programs. Participants in the program during fiscal 1985 were Lissa Martinez, Bruce Guile, and Meredith Golden.

Symposium Series on Technology and Social Priorities

The NAE Symposium Series on Technology and Social Priorities explores the implications of technologies for individuals, government, industry, and nations. Symposia in the series during fiscal 1985 were "Education for the Manufacturing World of the Future," "Information Technologies and Social Transformation," "Economics and Technology," and "Hazards: Technology and Fairness." Each of these symposia (described elsewhere in this report as elements of the Technological Leadership Program) brought together national leaders from academia, business, and government, and their presentations have been collected and edited for publication. The series is supported by grants from Carnegie Corporation of New York and The Andrew W. Mellon Foundation, which also support the NAE Fellows Program.

Contributors to the National Academy of Engineering

The following corporations, foundations, NAE members, and others have made pledges or contributions to the National Academy of Engineering in fiscal year 1985 and the first six months of fiscal year 1986 (July 1, 1985 - December 31, 1985).

Corporations and Foundations

The Aerospace Corporation
(In honor of Robert C. Seamans, Jr.)
Air Products Foundation
Alcoa Foundation
American Electric Power Company, Inc.
Amoco Foundation, Inc.
AT&T Foundation

Battelle Memorial Institute
Bechtel Group, Inc.
Arnold and Mabel Beckman Foundation
The Boeing Company

Carnegie Corporation of New York
CBM Engineers, Inc.
Chevron Corporation
Commonwealth Edison Company
COMSAT
Consolidated Edison Company of New York, Inc.

Dayton Power & Light Company
Detroit Edison Company
The Charles Stark Draper Laboratory, Inc.
Duke Power Company
E.I. du Pont de Nemours & Company

Exxon Corporation

Ford Motor Company Fund

General Electric Foundation
General Motors Foundation
Gulf Oil Foundation

Haley & Aldrich, Inc.
Hawaiian Electric Company, Inc.
Hewlett-Packard Company
Hughes Aircraft Company

IBM Corporation
Indianapolis Power & Light Company
The Irvine Company

Peter Kiewit Sons', Inc.
Knowles Electronics, Inc.

Lockheed Corporation

McClelland Engineers, Inc.
McDonnell Douglas Foundation
The Andrew W. Mellon Foundation
Midwest Research Institute
The MITRE Corporation
Monsanto

Niagara Mohawk Power Corporation

Ohio Edison

Parsons
Perkin-Elmer Corporation
Philadelphia Electric Company

Raytheon Company
RCA Corporation

Southern California Edison Company
Southern Indiana Gas & Electric Company
Southwest Research Institute
Stubbs Overbeck & Associates, Inc.

Tampa Electric Company
Texas Utilities Company
TRW Foundation

Unocal Foundation

Wisconsin Power & Light Foundation, Inc.

NAE Members

Agbabian, Mihran S.
Austin, T. Louis

Anonymous (3)

Banks, Harvey O.
Berger, Bernard B.
Bloor, W. Spencer
Bogdonoff, Seymour M.
Boyer, Raymond F.
Bray, A. Philip
Brooks, Harvey
Brown, David
Bryson, Arthur E., Jr.
Burnham, Donald C.

Cleasby, John L.

Daily, James W.
Douma, Jacob H.

Eberhart, Howard D.
Eggers, Alfred J., Jr.
Elkins, Lincoln F.

Geyer, John C.
Glennan, T. Keith

Hall, William J.
Hawkins, Willis M.
Hewlett, William R.
Hocott, Claude R.
Hodge, Raymond J.
Hogg, David C.
Holloway, Frederic A. L.
Housner, George W.

Irwin, George R.

Jonsson, J. Erik
(In honor of Walter A. Rosenblith)

Kohler, Max A.

Landau, Ralph
Lang, Martin
Lawroski, Stephen
Leps, Thomas M.
Leverenz, Humboldt W.
Lewis, W. Deming

Mark, Hans
Moore, John R.

Packard, David
Peltier, Eugene J.
Perlis, Alan J.
Piore, Emanuel R.

Rader, Louis T.
Roy, Rustum

Slichter, William P.
Stever, H. Guyford

Teal, Gordon K.
Tribus, Myron
Turner, Howard S.

Vollum, C. Howard

Weertman, Johannes
Wernick, Jack H.
White, Robert M.
Wilson, Basil W.
Wilson, T. A.

Other Contributors

Jansen, Robert B.

Vallerga, B. A.

Membership

Election to the Academy is the highest professional distinction that can be conferred on an engineer and honors those who have made important contributions to engineering theory and practice or who have demonstrated unusual accomplishments in new and developing fields of technology. In 1985, 67 new members and 5 foreign associates were elected, bringing total U.S. membership to 1,238 with 108 foreign associates.

1985 New Members

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Klaus D. Bowers, AT&T Bell Laboratories, Murray Hill, N.J.
Sol Burstein, Wisconsin Electric Power Co., Milwaukee
John C. Calhoun, Jr., Texas A&M University System
Alfred Y. Cho, AT&T Bell Laboratories, Murray Hill, N.J.
John V. Christiansen, Skilling, Helle, Christiansen, Robertson, Bainbridge Island, Wash.
Philip M. Condit, Boeing Commercial Airplane Co., Seattle, Wash.
Paul M. Cook, Raychem Corp., Menlo Park, Calif.
William E. Cooper, Teledyne Engineering Services, Waltham, Mass.
George B. Dantzig, Stanford University
James M. Duncan, University of California at Berkeley
Richard E. Emmert, E.I. du Pont de Nemours & Co., Wilmington, Del.
Charles A. Fowler, MITRE Corp., Bedford, Mass.
Donald C. Fraser, The Charles Stark Draper Laboratory, Inc., Cambridge, Mass.
Robert B. Fridley, University of California at Davis
Leslie A. Geddes, Purdue University
Richard J. Goldstein, University of Minnesota
James P. Gordon, AT&T Bell Laboratories, Murray Hill, N.J.
Hermann K. Gummel, AT&T Bell Laboratories, Murray Hill, N.J.
Robert C. Hawkins, General Electric Co., Boston, Mass.
Allan F. Henry, Massachusetts Institute of Technology
Lawrence H. Hodges, Consultant, Racine, Wisc.
William G. Howard, Jr., Motorola, Inc., Schaumburg, Ill.
Erich P. Ippen, Massachusetts Institute of Technology
Howard H. Kehrl, General Motors Corp., Detroit, Mich.
James F. Lardner, Deere & Co., Moline, Ill.
Thomas D. Larson, Pennsylvania Department of Transportation, Harrisburg
Ronald M. Latanision, Massachusetts Institute of Technology
Shih-Ying Lee, Setra Systems, Inc., Acton, Mass.
Fred E. Luborsky, General Electric Corporate Research and Development Center, Schenectady, N.Y.
John W. Lyons, National Bureau of Standards, Washington, D.C.

John B. MacChesney, AT&T Bell Laboratories, Murray Hill, N.J.
Craig Marks, TRW Inc., Solon, Oh.
Charles S. Matthews, Shell Oil Co., Houston, Tex.
Sanford N. McDonnell, McDonnell Douglas Corp., St. Louis, Mo.
Richard C. Messinger, Cincinnati Milacron, Inc., Cincinnati, Oh.
Philip M. Morse,[1] Massachusetts Institute of Technology
Warren H. Owen, Duke Power Co., Charlotte, N.C.
Yih-Hsing Pao, Cornell University
George P. Peterson, (retired) Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, Oh.
Robert Price, M/A-Com Linkabit, Inc., Lexington, Mass.
A. Alan B. Pritsker, Pritsker and Associates, Inc., West Lafayette, Ind.
Robert O. Reid, Texas A&M University
Allen F. Rhodes, Anglo Energy Ltd., New York, N.Y.
Ronald S. Rivlin, Lehigh University
Ronald E. Rosensweig, Exxon Research and Engineering Co., Annandale, N.J.
Lucien A. Schmit, Jr., University of California at Los Angeles
A. Richard Seebass, University of Colorado
Eugene Sevin, Defense Nuclear Agency, Washington, D.C.
Claude E. Shannon, Massachusetts Institute of Technology
Shan-Fu Shen, Cornell University
Reuel Shinnar, City University of New York
Franklin F. Snyder, Consultant, McLean, Va.
Ponisseril Somasundaran, Columbia University
Fred N. Spiess, Scripps Institution of Oceanography, La Jolla, Calif.
Robert C. Sprague, Sprague Electric Co., North Adams, Mass.
Charles W. Stephens, TRW Electronic Systems Group, Redondo Beach, Calif.
Gregory E. Stillman, University of Illinois at Urbana-Champaign
Eric E. Sumner, AT&T Bell Laboratories, Murray Hill, N.J.
Joseph F. Traub, Columbia University
George L. Turin, University of California at Los Angeles
Willis H. Ware, The Rand Corp., Santa Monica, Calif.
Walter J. Weber, Jr., University of Michigan
Vern W. Weekman, Jr., Mobil Solar Energy Corp., Waltham, Mass.
Sheila E. Widnall, Massachusetts Institute of Technology
Edward L. Wilson, University of California at Berkeley
Michael Yachnis, Naval Facilities Engineering Command, Alexandria, Va.

Foreign Associates Elected in 1985

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Hiroshi Inose, University of Tokyo
Francis L. LaQue, International Organization for Standardization, Ontario, Canada
Robert Malpas, British Petroleum Co. PLC, London
Michiyuki Uenohara, NEC Corp., Tokyo

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[1] Deceased

Financial Report

Following is the audited financial statement and supplemental schedule for the National Academy of Engineering Fund (NAEF). Governed by the Academy's trustees, the NAEF is the tax-exempt corporation (under section 501(c)(3) of the Internal Revenue Code) that serves as a holding entity for the independent assets and operating funds of the Academy. The supplemental schedule reproduced on page 26 includes the revenue and expenses of the NAEF and also the revenue, support, and expense of the NAE itself. The latter category includes funding that flows through NAS, such as the allocation of the overhead charge on government and private contracts administered through the National Research Council.

The increase in contributions and gifts in 1985 reflects the commencement of the Academy's 25th anniversary fund drive to support the Academy's Technological Leadership Program (formerly titled Decade III Program). The fund drive seeks to raise $30 million from private sources by its 25th anniversary at the end of 1990 to support a vigorous program of activities that will be carried out over the next ten years, the Academy's third decade.

A major source of revenue for the Academy is the allocation from the overhead charge on contracts for NRC projects. This allocation is used to offset expenses incurred in the Academy's oversight function and for such other administrative operations as its membership affairs and its governance.

Funding provided by foundations and government agencies for NAE projects has increased in the past year. These funds, which also support activities within the Technological Leadership Program, are designated for specific studies or projects, such as the Engineering Research Centers study for the National Science Foundation and the Technology and Social Priorities Symposium Series supported by Carnegie Corporation of New York and The Andrew W. Mellon Foundation.

Under a policy established by the NAEF Board of Trustees, the Academy does not use long-term investment earnings for operations but may use up to 4 percent of its investment assets for operations each year. This source of revenue, combined with the annual meeting registration fees and membership dues, makes up the remainder of the Academy's operating revenue.

The use and investment of contributions to the Technological Leadership Program are designed to ensure that funds will be available for the continuation of the program over the ten-year cycle. To accomplish this, approximately half of the fund drive's unrestricted contributions are placed in short-term investments to cover program expenses for the first five years, and the balance ($946,550 in FY 1985) is placed in long-term investment reserve for programs planned for the second five years. For example, referring to the supplemental schedule, the actual short-term revenue available for FY 1985 expenses was $2,283,587 (total revenue of $3,880,305 less the long-term reserve [$946,550], investment earnings [$255,074], lifetime dues [$49,490], and realized gain on sale of investments [$407,604], plus a transfer of $62,000 from long-term investment assets).

The increases in the Academy's expenses for 1985 reflect the beginning of the Technological Leadership Program. The modest expenditures for the Technological Leadership Program reflect only the start-up costs of the effort. Expenditures for the program during the first half of fiscal year 1986 indicate that the Program will expend approximately $1.4 million as staff buildup to carry through the projects is completed. At that level, any short-term operating surplus for the program, such as the $295,327 surplus in FY 1985 ($2,283,587 short-term revenue less $1,988,260 expense [$2,049,539 less $61,279 long-term investment management expense]), will disappear and the program will require significant increases in contributions and allocations from investment assets.

The Academy does not conduct proprietary studies for private clients or corporations. It does, however, welcome corporate and private gifts, which are used to help finance the research, educational, and public awareness programs of the institution. The investments of the NAEF are monitored by members of the NAE Finance Committee, listed on page 33, who use the services of carefully selected professionals. Over nine years, this investment management has yielded approximately $2 million net gain in market value of assets.

SUPPLEMENTAL SCHEDULE

NATIONAL ACADEMY OF ENGINEERING FUND

SCHEDULE OF REVENUE AND SUPPORT AND EXPENSES INCLUDING REVENUE AND SUPPORT AND EXPENSES OF THE NATIONAL ACADEMY OF ENGINEERING
For the Years Ended June 30, 1985 and 1984

	1985		1984	
Revenue and Support				
Revenue of the NAEF				
Total contributions received	$2,111,468			$ 200,075
Less contributions deferred due to restrictions	(306,000)			
Contributions currently recognized as revenue		$1,805,468		
Dues:				
Annual	60,400		$61,900	
Lifetime	49,490		49,730	
Total dues		109,890		111,630
Interest		141,827		105,085
Dividends		113,247		73,578
Realized gain on sale of investments		407,604		326,683
Total Revenue of the NAEF		2,578,036		817,051
Revenue and Support of the NAE				
NRC indirect cost allocated to support NAE operations		967,800		870,872
NAE programs funded by gov't/foundations		293,485		86,667
Registration fees		40,984		36,334
Total Revenue and Support of the NAE		1,302,269		993,873
Total Revenue and Support		3,880,305		1,810,924
Expenses				
Expenses of the NAEF				
Accounting, legal, insurance, dep'n, misc.		55,331		33,515
Investment management		61,279		60,801
Total Expenses of the NAE		116,610		94,316
Expenses of the NAE				
Operations funded by NRC		967,800		870,872
Operations funded by NAEF		246,211		318,023
Development funded by NAEF		259,706		4,792
Programs funded by NAEF		81,812		
Programs funded by gov't/foundations		293,485		86,667
Support of NRC/NAS projects		83,915		55,000
Total Expenses of the NAE		1,932,929		1,335,354
Total Expenses		2,049,539		1,429,670
Excess of Revenue Over Expenses		1,830,766		381,254
Allow. for unrealized appreciation (depreciation) in fair market value of investments		603,460		(1,490,772)
Net worth, beginning balance		4,353,984		5,463,502
NET WORTH, ENDING BALANCE		$6,788,210		$4,353,984

The accompanying notes are an integral part of these financial statements.

RAYMOND E. LANG & ASSOCIATES, P.A.
CERTIFIED PUBLIC ACCOUNTANTS

8401 CONNECTICUT AVENUE
CHEVY CHASE, MARYLAND 20015
(301) 654-4900

August 23, 1985

Board of Trustees
National Academy of Engineering Fund
2101 Constitution Avenue, NW
Washington, DC 20418

We have examined the balance sheet of the National Academy of Engineering Fund as of June 30, 1985 and 1984, and the related statements of revenue, expenses and changes in net worth, and changes in financial position for the years then ended. Our examinations were made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying financial statements referred to above present fairly the financial position of the National Academy of Engineering Fund as of June 30, 1985 and 1984, and the results of its operations and changes in its financial position for the years then ended, in conformity with generally accepted accounting principles applied on a consistent basis.

Our examinations were made for the purpose of forming an opinion on the basic financial statements taken as a whole. The accompanying schedule of revenue and support and expenses including revenue and support and expenses of the National Academy of Engineering for the years ended June 30, 1985 and 1984 is presented for purposes of additional analysis and is not a required part of the basic financial statements. Such information has been subjected to the auditing procedures applied in the examination of the basic financial statements, and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as a whole.

Raymond E Lang & Associates, P.A.

NATIONAL ACADEMY OF ENGINEERING FUND

BALANCE SHEET
As of June 30, 1985 and 1984

ASSETS	1985	1984
Current Assets:		
Petty cash	$ 50	$ 50
Cash in bank — checking	7,538	11,313
Cash in investment accounts	491,864	159,729
Cash in investment accounts-restricted	314,603	
Accrued income receivable	32,793	8,859
	846,848	179,951
Investments at Market Value	6,328,892	4,237,043
Office Furniture and Equipment	7,896	5,936
Less — accumulated depreciation	(1,977)	(594)
	5,919	5,342
TOTAL ASSETS	$7,181,659	$4,422,336
LIABILITIES AND NET WORTH		
Current Liabilities:		
Accrued expenses	$ 21,632	$ 10,808
Payable to National Academy of Sciences	57,215	57,544
Deferred revenue & restricted contributions, current portion	153,000	
	231,847	68,352
Deffered revenue & restricted contributions, non-current portion	161,602	
Net Worth	6,788,210	4,353,984
TOTAL LIABILITIES AND NET WORTH	$7,181,659	$4,422,336

The accompanying notes are an integral part of these financial statements.

NATIONAL ACADEMY OF ENGINEERING FUND

STATEMENT OF REVENUE, EXPENSES AND CHANGES IN NET WORTH
For the Years Ended June 30, 1985 and 1984

Revenue:	1985		1984	
Contributions — unrestricted		$1,805,468		$ 200,075
Dues:				
Annual	$ 60,400		$ 61,900	
Lifetime	49,490		49,730	
Total Dues		109,890		111,630
Interest		141,827		105,085
Dividends		113,247		73,578
Realized gain on sale of investments		407,604		326,683
Total Revenue		2,578,036		817,051
Expenses:				
Accounting services		30,450		30,093
Depreciation expense		1,383		594
Insurance		3,545		1,680
Investment management fees		61,279		60,801
Legal services		12,561		178
Miscellaneous		1,392		970
Other professional services		6,000		
Support for NRC and NAS		83,915		55,000
Transfers to National Academy of Sciences for expenses	489,530		228,937	
Adjustment for balance owed NAS at year end	57,215		57,544	
Net expenses paid by NAS		546,745		286,481
Total Expenses		747,270		435,797
Excess of Revenue Over Expenses		1,830,766		381,254
Allowance for Unrealized Appreciation (Depreciation) in Fair Market Value of Investments		603,460		(1,490,772)
Net Worth, Beginning Balance		4,353,984		5,463,502
NET WORTH, ENDING BALANCE		$6,788,210		$4,353,984

The accompanying notes are an integral part of these financial statements.

NATIONAL ACADEMY OF ENGINEERING FUND

STATEMENT OF CHANGES IN FINANCIAL POSITION
For the Years Ended June 30, 1985 and 1984

	1985	1984
Financial Resources Were Provided By:		
Excess of revenue over expenses	$1,830,766	$ 381,254
Items not requiring (providing) working capital:		
Depreciation	1,383	594
Deferred revenue and restricted contributions, noncurrent, received in excess of expenses incurred	161,602	
Realized gain from sale of assets	(407,604)	(326,683)
Working Capital Provided by Operations	1,586,147	55,165
Other Items Providing Working Capital		
Proceeds from sale of investments	6,662,593	3,110,401
Total Working Capital Provided	8,248,740	3,165,566
Financial Resources Were Used To:		
Purchase investments	7,743,378	3,230,069
Purchase of furniture and equipment	1,960	5,936
Working Capital Used by Operations	7,745,338	3,236,005
INCREASE (DECREASE) IN WORKING CAPITAL	$ 503,402	$ (70,439)

Increase (Decrease) in Components of Working Capital:		
Cash in bank — checking	$ (3,775)	$ (44,576)
Cash in investment accounts	332,135	50,482
Cash in investment accounts-restricted	314,603	
Accrued income receivable	23,934	(791)
Miscellaneous receivable		(17,250)
NAE funds administered by NAS		(10,623)
Accrued expenses	(10,824)	9,863
Payable to NAS	329	(57,544)
Deferred revenue & restricted contributions, current portion	(153,000)	
INCREASE (DECREASE) IN WORKING CAPITAL	$ 503,402	$ (70,439)

The accompanying notes are an integral part of these financial statements.

NATIONAL ACADEMY OF ENGINEERING FUND
NOTES TO FINANCIAL STATEMENTS
June 30, 1985

Note 1. Organization

The National Academy of Engineering Fund (NAEF) is an independent non-profit organization established by the National Academy of Engineering (NAE) to collect and disburse funds for accomplishing the goals of the NAE. The NAE operates within the charter and framework of the National Academy of Sciences (NAS), which accounts for the NAE's revenue and expenses. The principal operating expenditures of the NAE are accounted for by offices of the NAS and are offset to a large extent by reimbursement from indirect costs under contracts administered by the National Research Council (NRC) which is the operating arm of the NAS and NAE. The next expenditures of the NAE which are not considered indirect costs are paid by the NAEF to balance accounts with the NAS. The NAEF is incorporated under the District of Columbia Non-profit Corporation Act and has been granted an exemption from all federal and local incomes taxes.

Note 2. Summary of Significant Accounting Policies

The Fund uses the accrual basis of accounting. Revenue is recognized when earned and expenses are recognized when the obligation to pay is fixed. Contributions and earnings on those contributions which are restricted by the donors for particular purposes are deemed to be earned and reported as revenue when expenditures have been incurred in compliance with the specific restrictions. Such amounts received but not yet earned are reported as deferred revenue and restricted contributions.

Investments are held in trust by the American Security Bank, N.A., and are comprised of short-term investment units, publicly traded stocks, corporate and government bonds, and mutual stock funds. The investments are managed by financial advisors who are chosen from time to time. These investments are intended to form an operating reserve, which will provide income to support future programs.

The investments are valued at their market value. The investments had a cost of $5,692,694 at June 30, 1985, and $4,204,305 at June 30, 1984. At the time of sale, the average cost of individual securities is used as the basis for determining the realized gain or loss.

Furniture and office equipment are carried at cost. Depreciation is provided using the straight-line method using an estimated useful life of five years.

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Editor: H. Dale Langford

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